

Aviation Week

and Space Technology

75 Cents

A McGraw-Hill Publication

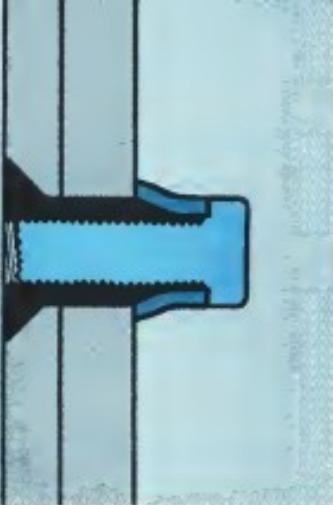
January 15, 1962

GE Investigates
VTOL Concepts

Nike Zeus Launching
At Pt. Mugu



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XLR

AEROSPACE CALENDAR

- 23-24 May—Annual Meeting, Inst. of the Aerospace Sciences, Hotel Astor, New York, N.Y. Honors Night, dinner, June 11

24-25 May—Annual Meeting, American Society of Civil Engineers, Washington, D.C.

24-26 June—Second Symposium on Thermophysical Properties, Princeton, N.J. Sponsored by West Coast Division, American Society of Mechanical Engineers

26-June—Symposium on Women's Problems in Science, Institute of Occupational Medicine, University of California, La Jolla, Calif.

28-June—Annual Convention, Service-Symposium Inst., Washington, Wash., D.C. Sponsored National Association of Service Agencies

29-June—Annual Meeting, Assoc. of Local Government, Washington Hotel, Washington, D.C.

29 Feb—3-June—Institute of Electrical Engineers, Welsh General Meeting, Royal Society and Colleagues, New York City

10-Mar—Board of Directors Meeting, August Operations Council, International Business Machines, White Plains, N.Y.

Feb—Workshop on Reliability Techniques for Computing Systems, Defense Institute of the Interior, Arlington, Wash., Wash., D.C. Sponsored Information Agency Research Branch, Office of Naval Research.

Feb 19—Third Winter Convocation at Military Electronics, IBM, Andoverland, Los Angeles.

March 19—Annual Meeting, ⁷¹

Continued on page 1

INFLATION, INCOME AND DEMAND TURBULENCE

Bonney IL, 1963

and the author has done his best to make it interesting and informative. The book is well written and clearly presented, making it accessible to a wide range of readers. The author's passion for the subject matter is evident throughout the book, and this enthusiasm is contagious. Overall, I would highly recommend this book to anyone interested in the history and development of the automobile industry.

10. The following table shows the results of a study on the relationship between age and income.

Editorial Board, correspondence, and changes of address, should be addressed to the Editor.

Reference: Please send form 1040 to IRS before April 15.



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moon

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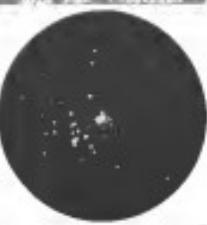
Main Plant and Headquarters: Chula Vista,
California; Plants: Bismarck, California / Louisville,
Kentucky; Works: Lancaster, Arkansas / Washington

AEROSPACE CALENDAR

(Continued from page 5)
Feb. 14-Heli-interplanetary: Solid-State Gas
Couch Conference, Institute of Radio En-
gineers, Sheraton Hotel and University of
Pennsylvania, Philadelphia, Pa.
Feb. 21-27-Candles: Candles Month. Cen-
tral American Society for Metal, Tin
and Zinc Alloy Products, Calif.
Feb. 19-21-Titanium & Composites of Aero-
space Vehicles, Institute of the Aerospace
Sciences, San Francisco, Calif.
Feb. 22-Fire Women's Space Symposium,
Andromeda Hotel, Los Angeles, Calif.
Feb. 27-Mar. 1-Third Annual Symposium
on Test Engineering, Test Engineers of North
and Middle America, Inc., Sheraton
Galleria Hotel, San Antonio, Tex. Sym-
posium South Texas Section Society for Mea-
surement Testing, Southwest Research
Institute.
Feb. 27-Mar. 3-Symposium on the Appli-
cation of Switching Theory in Space
Technology, Sheraton Calif. Airport
Inn Hotel, Burlingame, Calif.
Mar. 3-8-Solid State Components in Car
Interiors and Personal Gear, American So-
ciety of Mechanical Engineers, Stan-
ford White Hotel, Stamford, Conn.
Mar. 8-9-Meeting of the Aerospace So-
ciety, Phoenix Meeting, Stamford,
Conn. Stamford, Conn.
Mar. 14-16-Propulsion Conference,
American Rocket Society, Hotel Cle-
ment, Toledo, Ohio.
Mar. 18-Jewel Robert H. Goddard Me-
morial Symposium, "Wagons and At-
oms in Skylab," American Astro-
nautical Society, Washington.
Mar. 26-29-Communication, In-
stitute of Radio Engineers, Coliseum and
Waldorf Astoria, New York.
Mar. 26-29-Third Symposium on Engi-
neering Aspects of Magnetohydrodynam-
ics, University of Rochester, Rochester,
N.Y. Sponsored American Institute of
Electrical Engineers, Institute of the Am-
erican Rocket, Institute of Radio En-
gineers, University of Rochester, Rochester,
N.Y.

Apr. 1-4-Mid-Tier Conference, Airport
Operator Council, Sheraton Hotel,
Washington, D.C.
Apr. 1-4-Mechanical Vehicles Structures and
Materials, Conference, American Rocket
Society, Remond Inn, Phoenix, Ariz.
Apr. 3-6-National Aerospace Meeting, na-
tional production forum, Society of
Aerospace Engineers, Hotel Cortez
Hotel, New York, N.Y.
Apr. 10-12-Space Interference: Its Impact on The
Planets, Satellite Effect Upon Remote
Communication and Detection, New Eng-
land and Middle Atlantic Sections, American
Geophysical Research Laboratories.
Apr. 13-Electrochemistry Conference and
Electronics Show, Institute of Radio En-
gineers, Hotel Roosevelt, New York.
Apr. 14-Helicopter Technical Meeting and
Exposition, Exposition, Institute of En-
vironmental Sciences, Remond Hotel
Hotel, Chicago, Ill.
Apr. 14-16-Seminar Conference on Robotics.
(Continued on page 9)

WITHOUT VIDEO PROCESSOR



SolvED:

Mutual interference

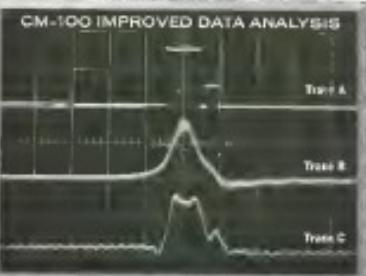
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AEROSPACE CALENDAR

(Continued from page 7)
 April 14-16—Symposium on High Temperature Systems, University of California Los Angeles, Calif. Sponsor: Westinghouse Electric Corp.
 April 16-18—Second International High-Tech Manufacturing Symposium, College of Aeronautics, Cranfield, England
 April 18-20—Aerospace Systems Reliability Symposium, Institute of the Aerospace Sciences, Salt Lake City, Utah
 April 24-26—Symposium on the Mathematical Theory of Structures, Harvard Engineering Center, New York, N.Y.
 April 25-26—World Space Age Reliability and Engineering Exposition, Cox Palace San Francisco, Calif.
 April 30-May 1—Meeting of the American Society of Naval Engineers, Hotel Chase, St. Louis, Mo.
 May 1-E-Spring Joint Computer Circular, General Hotel San Francisco, Calif.
 May 2-4-6-8—Annual National Forum, Hotel Inter-Continental, 1000 Avenue of the Americas, Calif.
 May 2-4-6-8—International Space Environment Symposium, Hotel Washington, D.C.
 May 2-4-6—International Space Research and Technology Exchange, Dijon, Louvois, England. Sponsor: British Interplanetary Society
 May 3-6—First International Congress on Thermal Factors in Electronics, Institute of Radio Engineers, University Hall, Long Beach, Calif.
 May 7-9—Materials & Processing for Space Environments, Symposium Society of Aerospace Material and Process Engineers, Hotel Statler, St. Louis, Mo.
 May 7-11—Annual Conference, Society of Aerospace Sciences and Engineers, Society Hall, Boston, Mass. Conference to Penn-Cambridge Research Laboratories
 May 8-10—Cal. Annual Electronics Conference, Conference, Mission Inn Bridge, Mission Viejo, Whittier, Calif.
 May 14-17—Annual Meeting, National Council of Societies of Venetian Metal Engineers, Superior Frictional Hard Metals
 May 18-25—Eighty-Second International Conference, Institute of Radio Engineers, Illinois Bell Telephone Co., Chicago, Ill.
 May 24-30—International Technical Seminar, Department of Defense, Symposium on Thermoelectric Conversion, Antigua Island, Caribbean Sea, Calif.
 May 14-17—Annual Meeting, National Council of Societies of Venetian Metal Engineers, Superior Frictional Hard Metals
 May 25-26—National Aerospace Electronics Symposium and National Telecommunications Conference, Shreveport Hotel, Shreveport, La.
 May 25-26—National Aerospace Electronics Symposium and National Telecommunications Conference, Shreveport Hotel, Shreveport, La.
 May 26-27—Conference on Solid-State Devices and Materials, University of Southern California, Los Angeles, Calif.
 May 27-28—Conference on Solid-State Devices and Materials, University of Southern California, Los Angeles, Calif.
 June 1-2—Symposium on Standards for Ultrahigh-Speed, Random-Phase, Solid-State Oscillators, Laboratories, Silver Spring, Md.
 September 11-15—Navy Aerospace Society for Testing and Materials

AVIATION WEEK AND SPACE TECHNOLOGY, January 15, 1962

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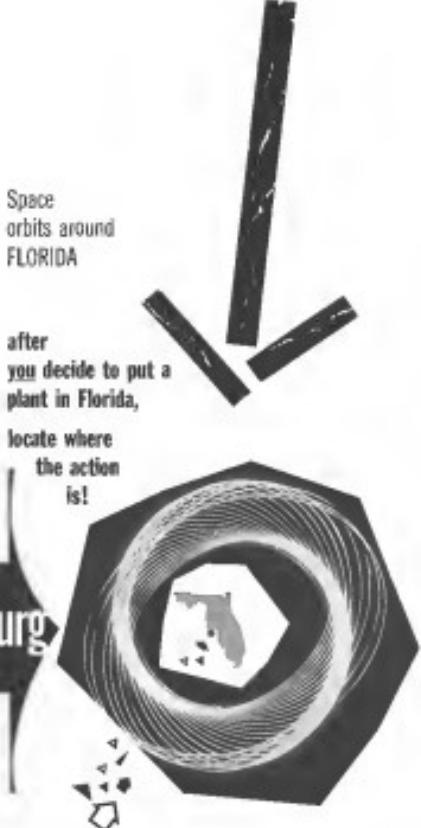
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THE QUIET MEN

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Our nation's investment in military and scientific research alone is already yielding dividends in terms of America's economic growth. Many of the new jobs, products, services, and even industries that today loom large on the American scene are the fruits of ideas put to work in the last decades.

Since its earliest days, America's aviation industry recognized the significance and need for extensive research activities. Today the aviation industry is better known as

the aerospace industry. No longer is it known only for its leadership in aircraft. It is now recognized as a dynamic force in many other fields: chemistry... computers... nuclear energy... communications... life sciences... electronics... propulsion... space technology... navigation.

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EDITORIAL

Space Pace Accelerates

As we predicted about this time last year (AVW Jan 16, p 21) the pace of the U.S. space program has been accelerated significantly during 1961. President Kennedy's established last spring of instant space flight to the moon is a national goal goes the program a good long way. Local point award which to develop the broad spectrum of space technology, the nation needs to do its best both in this country and abroad we find there is still a basic public misconception regarding the significance of the human leading program, although we are sure the Soviet space satellite group is just right accurately. Too many people regard the human landing either as a spectacular show or as the end product of our space program. If either of these two views were valid, the Apollo program would not be worth the price we will pay for it, either in taxpayer dollars or in the time and energy expended by our best scientific and engineering brains.

Program Facial Point

Fortunately, neither of these views is valid. The moon program, with its high national priority, is simply a focal point around which to develop effectively the broad base of space technology that is necessary for our economic, military, and international prestige requirements at a minimum. Once past the initial manned orbital flights, the moon is the next logical goal of normal exploration. As such, it is probably the best nucleus around which to organize an expanded, accelerated, and technically aggressive space program.

To land men on the moon, permit them to explore it and return safely to earth, it will be necessary to learn virtually all of the current and scientific knowledge along the frontiers of space technology. It will also be necessary to design and construct all types of space vehicles that will be required for both civil and military operations in space and to perfect operational techniques for virtually all of them. This is particularly true for the key techniques of orbital rendezvous and high velocity controlled reentry, for mastery of both must be achieved before any substantial extension of manned space flight is possible beyond low orbits.

We respectfully suggest to the top-level officials of NASA that they devote considerable time and effort this year to have effective explanation to both Congress and the American people of the full technical and economic significance of the Apollo program. If this does, they

can expect a reaction of public and congressional influence to become evident in 1962. This influence could make it easy for legislation to add a fiscal year and reflect the space program with financial means put which its technical pace would be gathering significant speed.

After the Apollo program was established as a national goal, the most significant acceleration of the space program became evident in the series of technical competition and contract awards that has put the huge booster program into high gear and placed virtually all of basic Apollo hardware development programs into the hands of industrial contractors. At the same time, most of the basic equations required for the Apollo program were satisfied and are now under way. This is truly a remarkable achievement for both the technical and administrative levels of NASA.

Another hopeful sign appearing on the space horizon with the new year is the indication that NASA and the Air Force Systems Command are establishing an effective liaison at all working levels (AVW Jan 1, p 26). We do not consider orbital space far off to explore among the agency of this military-civil fusion for a truly effective national space program. We also outlined the areas where the existing business machinery was inadequate. It is gratifying now to see these genuine programs being made in this vital area.

Lunar Program Enthusiasm

NASA has done a notable task in getting the Apollo program rolling, and now with Vice President Lyndon Johnson, Dr. Edward Welsh, executive secretary of the space council, and James Webb, NASA administrator, have done a remarkable job in exciting the interest of President Kennedy and congressional leaders in the space program as a significant national goal.

One of the major problems still remaining is to ensure the sustained support of the American people and their legislative representatives behind the space program that has been so boldly charted and swiftly accelerated. For this program is not adequately explained to the American people they will soon become weary with it once the novelty of space spectacles wears off, and the familiar twin of saddleback and false economy that have plagued so many other promising programs will take over the space program.

—Robert Holt

Be practical

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Complete technical data, including "Pole-E" recommended resonance characteristics is available from your Amphenol Sales Engineer. If you prefer, write Dick Holt, Vice President, Marketing, Amphenol Connector Division, 1810 S. 54th Ave., Chicago 36, Illinois.

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Space Vehicle Systems Analysts for Space Technology Leadership



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WHO'S WHERE

In the Front Office

John Arleigh Burke (USN, ret) and Gen. David E. Clegg (USA), ret, elected chairman of Technical Consulting Corp., San Jose, Calif.

Frank W. Gable, vice chairman board chairman of Dex-Gal, Inc., Orlando, Fla.

Thomas L. Phillips, executive vice president, Matthew L. Luengens, Matt Phillips, a general manager of the company's engineering group, Atlanta, Ga.

Thomas R. McNamee, William B. Reiter, vice president of Lockheed-Georgia Co. Matsuda Co. is a division of Lockheed Aircraft Corp. Reiter is now vice president of Lockheed-Sudia International, Los Angeles, Calif. Other Lockheed-Georgia appointments: Thomas J. Morris, administrative director; Maurice M. Ryan, director of financial operations.

George H. Sallman, M.D., corporate vice president, Spectrolab, Inc., Van Nuys, Calif. Dr. Sallman continues as the company's medical director.

Ken T. Fawcett, vice president, marketing and organizing, Schenck Worldwide, Dallas.

Joseph M. Herkovich, director vice president defense systems, Defense Electronics Products, Radio Corp. of America, Gendron N.J., succeeded John H. Schleicher, now director of communications and public relations, Major Systems Division, Defense Electronics Products, Mountain View, N.J.

Henry P. Hall, Jr., executive vice president, Arthur Drexler Co. of New York, New York.

Walter A. Haas, director, Management Analysis Division, Office of Administration, National Aerospace and Space Administration, Washington, D.C.

Honors and Elections

Frank W. Park, vice president-engineering products, the RAND Corporation, California, received the award of the Society of Automotive Engineers for 1962.

Gen. Charles B. Dornan has earned the following in the Order of the Bark (Military Division, Am. Merit Soc): Charles Borch, S.M., commander-in-chief, Middle East Command; Gen. James Marshall George Agius, Walker, commander-in-chief, Air Force Command, Acting Adm. Ronald Douglas G. Moore, chief of staff, Naval Air Forces, Central Europe; Harry Hartmann, general secretary, Ministry of Aviation (Conf).

Changes

Dr. Arthur Radford, assistant director, Systems Engineering, National Aerospace and Space Administration, Office of Manned Space Flight, Marshall Space Flight Center, Huntsville, Ala. Also Dr. J. R. Kastner, in charge of the Systems Engineering Division, NASA Langley Research Center, Hampton, Va.; Dr. Robert E. Smith, NASA Marshall Space Flight Center.

Ronald N. Mandell, engineering manager, Los Angeles Division, Dex-Gal, Inc., Los Angeles.

A. M. (Tom) Johnson, Dex-Gal program manager manager, Aerospace Division, The Boeing Co., Seattle, Wash.

INDUSTRY OBSERVER

►Cost of developing the USAF-Douglas Skybolt air-launched ballistic missile currently is planned at about \$450 million, which makes this one of the critical contracts for developing a missile that would have had considerably longer range and higher accuracy than the six previous programmed USAF missiles using additional funds to accelerate the program but was cut down by Defense Department.

►USAIR, holding on proposed aerospace-industry alliance (NDRBMI), is unanimous. Republic Jet contractors will be invited to industry via the basis of associate contractors for these areas: propulsion, command and control, guidance, avionics, vehicle, transporter-launcher, and the integration, assembly and checklist management.

►Discoverer program, which was to have ended last year, now has sound down eight additional aircraft assigned. USAF's Strategic Command wants to launch about 18 Discoverer per year, starting at test flights for Space reconnaissance and Midas tests, warning satellite nations, components and techniques.

►NASA's Jet Propulsion Laboratory is considering a combination of Titan II and the Argus C as an alternative to the Atlas-Centaur as a launching vehicle for the Mariner 8 deep space probes to be fired in 1968. Mariner II probe probably will be designed to fit within a 10-ft-dia. fairing.

►Air Force Electronic Systems Division joins with major aerospace companies for design and fabrication of dual air transportable AN/TRN-47 transversal air-to-surface systems designed for quick deployment to areas that have no existing facilities (AFM 79, p. 39). The system will include a search radar, precision approach radar, communications, VTR and IFR, laser site plots on AN/ANR-17 transversal. Tests no option and will be given concurrent launching. Early delivery will be a major factor in the selection of a contractor.

►Competitors for a lightweight, precision atomic mass beam which could automatically measure UHF distance signals from a slowed pilot will be held soon by Navy's Bureau of Weapons. Beam probably will weigh not more than two pounds and would include provisions for short-range voice communication between the probe and search aircraft.

►At least one firing in USAF's Project Anti Interference/Countermeasures system evaluation test is expected this calendar year, with several more scheduled for next year. Alert calls for launching of a series of low-orbit glider models in the 1968-1969 liaison to study effects of heating on structure of the tips to be used on Dyna-Soar and related air-powered flight vehicles (AFM 78, p. 31). Gliders will be fired in altitudes of 70,000 ft and altitudes of up to 400,000 ft.

►Minuteman II/Boneyard has been chosen by Naval Defense Test Station, China Lake, Calif., as part in preparation of the Advanced Research Project Agency-sponsored forward and off-axis-inlet measurement study, called Talisman (AFM Jan. 1, p. 13).

►Ground insulation of arenas for pilots of the Dyna-Soar orbital glider will be affected in a one-pilot seat and when four-seat capsules of the flight and landing seats. Movement in the inflated Dyna-Soar suit is reported to be much easier there in the Mercury suit.

►Russia claims geophysicists have been using thermally loaded rockets猛攻 to break up and move up reaching snowdrifts in the Altai-Ulba Valley of the Gobi Desert Soviet Republic. Explosive agents on the peaks of the Tali-Gudzovsk Range are used as firing sites. Rockets of the approaches to the valley give warning of the haul.

►Satellite per cent of all NASA space launches are planned for this year and half are managed by its Goddard Space Flight Center.

SILICOLOGY

Studies in Silicones

HOW THESE TIME-TESTED MATERIALS
CAN WORK FOR YOU

Turn on the heat— Silicone-based coatings can take it!

If you ever hit the outstanding characteristics of silicone resins, chances are that "heat resistance" would rate near the top.

Most manufacturers who formulate high-temperature coatings have long been aware of this important property and are turning more and more to silicone resins as a base for their products. These range all the way from lubricants, protective coatings for electrical applications in special paints used as sealers and sealants, jet aircraft engines, and other advanced space vehicles.

In many cases, the choice is silicone resin inevitably leads to one made by Union Carbide, only because of its unmatched stability and durability, but because each has been specifically designed to meet a specific plant requirement.

LOW-TEMPERATURE GURU

Take Union Carbide's TI-620, for instance, a new low-temperature curing resin which has been widely adopted by the paint industry at a base for aerospace fluids and for protective coating materials, glassware and other high-temperature electrical equipment. Electrodes for H-620 are but two more of the hundreds of problems inherent in the use of either silicone resins and may be applied over any suitable surface by spraying, flow coating, brushcoat or dipping. High temperature stability and low temperature thermal expansion coefficients, it can be blended with acrylics to make them an proved thermal stability and resistance to weathering.

The cold stage is virtually limitless and high-temperature materials based on H-620 have outstanding durability, soft spray resistance and water repellency. In addition, paints based on H-620 can be packaged as aerosol sprays for exterior use, home, event, stoves and radiators.

LOW-COST ALUMINUM PAINTS

To combine economy with performance, many large-scale users of paints are adopting UNION CARBIDE R-64, a silicone resin which can be cold-blended easily



Silicone base aluminum paint, which provides surface protection up to 1200 deg F, is recommended for aircraft and missile programs. It is also used in North Sea crude distillation. The paint is made by Union Carbide in Canada, U.S., Mexico, France, U.K., Germany, Italy, and Australia under license granted by Union Carbide.

with many organic resins at vehicle for aluminum paint. With only 7 to 11 percent by weight of silicon added to the formulation, aluminum paints of this type provide outstanding protection in the 300-1000 deg F range and still retain their ability to withstand severe high-temperature conditions.

Applied by brush or spray, such paints are used as protective coatings for aircraft engines and exhaust stacks, truck and engine manifolds and mufflers; insulation covers; stove and heater ducts and metal smoke stacks. Heat and insulation protective clothing can also be fabricated from asbestos cloth coated with silicone paint based on R-64 organic blends.

MAXIMUM THERMAL STABILITY

If factors of heat, weather and insulation constitute a major problem for you, take a look at still another Union Carbide product, R-631. Developed specifically as a resin vehicle for metallic and nonmetallic pigmented, high-temperature

coatings, it provides the ultimate in thermal stability and offers far greater heat, weather and corrosion resistance than organic paints. Typical applications are in paints for wire, capacitors, high-temperature electrical equipment, lamp shades and reflectors, insulating stacks, printing, insulation, generators and high-temperature insulation equipment such as fireproof or vapor insulated wall metallurgical furnaces.

R-631 liquid paints can also be packaged in aerosol sprays for insulation use in home ovens, stoves and radiators.

LASTING QUALITY

Silicon-based organic resins are a good choice for protective protection for longer periods of time. If you have a serious performance problem, look to Union Carbide Silicones for your answer. Your Siloxane Mat is a 15-year service record. It is not only, but because, but the most experience and research of Union Carbide Corporation in virtually every field of industry. For information and help fill in the attached coupon and mail it today.

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Washington Roundup

Space Labor Study

Secretary of Labor Arthur J. Goldberg, who has helped settle labor-management disputes in fields ranging from grain stores to the airways, will visit Martin Marietta Co.'s plant at Middle River, Md., probably late this month, to take a direct look at the problems created by罢工 and go in the middle and space program. Goldberg and his team will make a pace study of Martin's striking.

Marietta announced last month that it would have to lay off 2,500 employees because of completion of some government work and failure to gain new contracts. Middle River was on the Titon 2 list as a Dyno-Sonic booster in mid-August because an F-106 had cleared the solid-boost part of the program and will use Titon 3 in orbital flights, but work on the Mariner interplanetary flight completed.

Marietta had hoped to take up the slack by winning National Aerospace and Space Administration contracts for either the Saturn V or the Apollo spacecraft but lost both. Since the firm was awarded the Mariner contract, Marietta project leaders have been urging the federal government to solve the management problem by merging space and defense divisions in Mariner.

Goldberg's memorandum to President Kennedy after his Mariner visit concluded: "I believe the timeliness of President Kennedy's action in solving the management problem in Mariner, where the influence involved in the space program should be great."

Civil Aviation Board will propose "some changes" in the bill passed last year by the House and Senate but never signed because a joint House-Senate conference that would have given it an implement nation permanent status, Chairman Alvin Boyd told a House subcommittee last week. The subcommittee is investigating the implementation as a result of the recent Imperial Airlines crash (see p. 48). Board and "solidified recommendations" will be passed out to Congress as a result of a CAB/Federal Aviation Agency investigation of the supplemental section. The Board has yet to approve the proposed change, and Boyd did not say what they might be.

CAB will delegate authority to an liaison and their division to settle air-carrier disputes, effective Jan. 20. Previously, liaison and division could appeal but could not file a proceeding action such as application to conduct or restrain MATS charter operations. This had to be referred to the Board for final. Staff decisions can also be appealed to the Board, but only once. The change is a result of Congress' passage of the July 30 Fairmont-Kennedy's negotiation plan for CAB.

Federal Communications Commission has taken out of its position that ownership of a space communications system should be limited to international interests owners. National Aerospace and Space Council has recommended a broad base of ownership. FCC has great influence with the House and Senate commerce committees. Legislation proposed by Sen. Robert Kerr, chairman of the Senate space committee, would give FCC the authority to decide which noncommunications companies would share in ownership of the system.

Rep. George Miller, chairman of the House Armed Services Appropriations Subcommittee, has accepted Secretary of Defense Robert McNamara's decision to withdraw the \$55.6 million set aside by Congress last summer for the Defense Dept. for \$51.5 million, cut for strategic bombers, and the \$10.0 million voted for accelerating development of the B-70 bomber. Given a choice between spending additional money for B-52s in accelerating the B-52 development program, Rep. Miller would favor the former.

Deadline for industry's comments on Defense Department's proposed guideline for incentive contracts has been extended from June 2 to June 30. The proposal was circulated to industry last Dec. 5.

Proposed for a four-year, \$5 billion-a-year civil defense program will be opened by Rep. Chet Holifield, chairman of the Joint Congressional Committee on Atomic Energy. Placing no civil defense cost in the agenda of the Governmental Affairs Operations Subcommittee, which Rep. Holifield also heads.

Dr. Nicholas E. Collier, agency director of space engineering in NASA's Manned Space Flight Office and chairman of the joint Defense-NASA Large Launch Vehicle Planning Group, will become technical assistant to Dr. Robert G. Schuman, Jr., successor administrator. Dr. Joseph Stine will replace Collier in the systems engineering job.

NASA may present its budget request to Congress in two rather than three budget categories. New programs would be in one called research, development and operating and existing ones continued. Last year, requests were split into research and development, administration and expenses and construction of facilities.

John Charles R. "Cat" Brown, who served as NATO's communications chief, recently became, on Jan. 1, vice president McDonnell Douglas as European representative. —Washington Staff

Navy Plans to Launch Quintuple Satellite

Single launch vehicle to carry five separate units; experiments require orbits reaching high latitudes.

Washington—Navy will attempt to put five separate satellites into orbit with one launch vehicle on Jan. 24 or 25. The payloads to be known as the Composite 1 satellite, as scheduled to be launched from Cape Canaveral, Fla., into a 500-mi. alt. orbit that will carry them over high latitudes.

Three of the payloads are types that have been test run before or are piggybacks on Transit experimental navigation satellites, and two are new. Four will be kicked into their own orbits and one will remain attached to the AbleStar second stage of the USAF's AbleStar bus launch vehicle.

Main purpose of Composite 1 is to carry experiments that require an orbit reaching high latitudes. To achieve such an orbit, an inclination of 67.5 deg from the equator was chosen. Ideally, the orbit will be an almost circular as possible. It will be monitored a sufficient orbit if the perigee is not less than 400 mi. and the apogee does not exceed 600 mi.

Total weight of the five payloads will be 729 lb. Their range is set from 20° to 55° in longitude in six directions. The payloads are:

- Solar Radiation 4, which will be no more than 58.4.
- Europa 2.

Payload Management

Out of management and ownership of Composite 1 is under Navy's Bureau of Weapons. The Naval Research Laboratory is responsible for payload preparation and for management of SR-4, Europa 2 and Soviet orbiter. Navy is under its guidance of the State University of Iowa and Dr. James A. Van Allen. This organization also will con-

trol Iridium 2's operations in orbit. The Soviet satellite is sponsored by the Army Corps of Engineers Research and Development Laboratory.

Aerospace Corp. will have overall management of the launch vehicle, including mission engineering and technical direction and integration of the satellite payloads with the launch vehicle.

Launch of Composite 1 will be the responsibility of the Air Force Space Test Division. The 455th Test Wing (development) of USAF's 8th Strategic Aerospace Division will conduct the launch.

Space General Corp., Intersat Space Electronics Corp., will build, assemble and test the AbleStar stage. It also will furnish the electronics for AbleStar except for guidance which is furnished by Bell Telephone Laboratories.

Space Technology Laboratories, will be in sole orbital computations and directions from an space navigation center.

SR-4 is an aluminum sphere 20 in. in diameter and is a modification of previous nuclear radiation satellites which were sometimes called Gorbis satellites. Incorporated in the sphere will be three X-ray detectors and one Lyman alpha detector.

Luminous radiation is a high-energy special or secondary, low in the Far ultraviolet range. This glow in the sphere is believed to be produced by excited hydrogen atoms.

Soviet balloons also do in space. It is presented that there is a significant amount of luminous radiation that might be a source of danger to crews of space vehicles. It could produce erratic behavior and damage the crew X-ray sensors which have noise margin, and as density wave length, are potentially more dangerous.

One of the detectors in SR-4 will be shielded from Van Allen radiation belt effects to the use of magnetic fields. The fourth will be shielded by berillium.

SR-4 will have a greater wave length and shorter range than the previous SR-3 satellite, making it possible to determine ionosphere and harder X-ray. One result of the experiment is expected to be a measurement of the sun's electron temperature.

SR-4 comes into the earth's shadow, the Lyman alpha experiment will be started by ground command to measure the earth's magnetohydrodynamic field around the earth's magnetic dipole. This experiment will be correlated to latitude and longitude to determine what geomagnetic variations occur. SR-4 is expected to remain in orbit one year and will send data during that period.

The Europa 2 satellite is expected to

begin Iridium 2's operations in orbit. The Soviet satellite is sponsored by the Army Corps of Engineers Research and Development Laboratory.

Aerospace Corp. will conduct payload engineering, two photometers and two magnetometers. It will relay data via a digital telemetry system on command from the ground. It will provide many moments to monitor effects on the earth's outer radiation zone, and will measure light intensity, caused during particle activity in the wave length range 5,674 to 6,100 angstroms. It will also measure the electron energy spectrum in the outer radiation zone above the level of normal activity.

The Soviet satellite is an aluminum sphere 20 in. in diameter. Bonyly Sfera is a transponder that will gather geodetic data which will be transmitted to the ground. It will also collect and analyze data. This data will be used later to control the orbit of AbleStar satellite which is under the coordination control of the Army. Army is expected to produce instruments to measure changes in the shape of the earth beyond that discovered by the Navy's Transit satellite and to tie the earth's data together with greater accuracy than before.

Europa 2 will concern permanent operation in the very low frequency electromagnetic range to measure how well these frequencies penetrate the ionosphere. Naturally, much of the electron magnetic energy at these frequencies is scattered in the ionosphere and carried around the earth if they are traced through the atmosphere. This range of frequencies may be useful in future communications.

One of the highlights of Europa 2 will be the determination of signal attenuation through the atmosphere in relation to latitude, with the polar regions getting the closest attention. Earth's Latitudinal seasonal variation data numbers are incomplete after about four day to night and the latitude, with the best transmission being measured at low latitudes at night.

The Soviet experiment is contained in a cylinder that is 3.5-in. in diameter and has a 10-in. total radius. It will be able to be placed in ground equipment, to need data for a one-month period during each orbit. This signal will be used by calibration of the space navigation reference system which will be tracking the satellite. It also is indicated that Soviet will carry an optical tracking unit.

From about the Thor-Delta stage will have about 165 sec. After the Thor burns out the AbleStar stage will be ignited and will burn for about 250 sec to about 455 sec after takeoff. A long coasting period will follow. At approximately 1,730 sec after liftoff the Able-



Five SATELLITES will be orbited with one launch vehicle by the Navy later this month from Cape Canaveral, Fla. Three of the instruments—2, 3, 4 and 5 (previously called Goldstone)—have been shown. Europa 2 comes below. Soviet 1 and Soviet 2 boxes for the first time.

Star will be restarted to assist the satellite into orbit during a 16sec. burning period. Ignition will be completed just before reaching the South Georgia Islands.

Data for control of the AbleStar station will be gathered by a mobile tracking station which will be situated near Puerto Ayora, Argentina, at the south end of the South American Bays on the Andes. Data on the AbleStar model, histories of payloads into orbit and payload quantization will be transmitted to the space navigation center for rapid computation and transmission of control signals to the mobile station and other stations which will aid the command signals.

After insertion into orbit, the first satellite to be maneuvered will be the SR-4, which will be attached to a rap-

port tube on the AbleStar. It will be separated by a spring. During guidance around the sun, the tubes will digests more than 100,000 ft of the tubes. The tubes 2, 3 and 4 will be used. Each one will be at the end of a spike fastened at the base of the support tube. They will be separated in the order mentioned above. Soviet will remain attached to the AbleStar stage.

The boost and coasting phase of Composite 1 will take the vehicle over most of South America. It will pass over Colombia, Venezuela, Ecuador, Peru, Brazil, Bolivia, Argentina and Chile again.

The South Georgia Islands, over which injection into orbit is completed, are located about 830 mi. east of Puerto Ayora.

Kennedy Stresses Economic Strength

Washington—President Kennedy will ask the FID Congress for a series of economic devices to strengthen the U.S. against the Communist offensive because, he said, situation at home "leaves us open."

President Kennedy emphasized diverse economy as key factor of the Union Message delivered in Congress Dec. 18. He said that effective social and physical strength begins at home. The country must retain strength both in nuclear and conventional military forces because we "live by them in many levels."

The President presented most of his requests in outline form with details to follow throughout the session. In his defense program he said:

- A massive insurance and development plan to provide new jobs and jobs for workers entering the labor market, and for those who have lost their jobs because of automation.
- A 5% tax credit for new investment in warehouses and equipment, and a similar deduction dimension. These factors will spur modernization the most effective competitor in the world market.
- Stimulus authority to accelerate deficit capital investment program if unemployment rates and similar authors subject to congressional veto, to reduce present income level from a 20% level to 15%.

President Kennedy cited the strengthened military posture of the U.S. and the "post-new effort to enter space" which began in May with strong congressional backing.

In the past 12 months," he said, "our military posture has steadily improved. We have increased the present defense budget by 15%—a rate that doubled the acquisition rate of Polaris submarines—despite the production exports for Missiles and aircrafts increased by 10% the number of assault bombers standing ready in 15 months alone."

He cited space as "the new frontier of science, commerce and world-wide expansion" that the nation is taking using the first to explore it. "We are offering our laws and cooperation to the United Nations. Our scientists will soon be providing other nations with improved weather observations." He said he will soon transmit to Composite 1 plan to prevent freezing and spreading of ice between remote communities by satellite systems.

Defense Budget May Aid Service Unity

By George C. Wilson

Washington—Technique for putting together the \$55-billion Defense Department budget that Congress must enact this week may prove to be the best test yet of defense's method of trial and for verifying the functions of the armed services.

President Kennedy's defense budget for Fiscal 1963 has been put together to go beyond defense and major general services in both the air and the house to departmental supports, money and the way Congress appropriates it.

Immediacy factors in on the defense budget because of the reason it is so concentrated. Instead of waiting for the money requests of the individual services, Secretary of Defense Robert S. McNamara ordered Air Force, Army and Navy, leaden to collaborate on the total budget. This development, needed for maximum savings, cuts damage already to military research.

The result, for example, that the military offices had to wring between stand alone and no-build routes in putting together the package for carrying out the mission of the strategic information forces. They also were directed to eliminate costs of the elements in the package through Fiscal 1967. Only after McNamara approved the total package were the money requests allocated to the individual services.

Taylor Urged Plan

The idea is not new. Gen. Maxwell D. Taylor, former Army chief of staff and now an advisor to President Kennedy, has advocated such an approach.

He told the Senate National Policy Committee Subcommittees on Armed Services

Sergeant Production

Army's cold-forged Sergeant and side plate heat exchanger was developed with consultation (AW Oct. 23, p. 21), it now is produced at the Sperry Utica plant.

Sperry was awarded a contract Jan. 7 for \$1,091,300 to cover initial engineering services for the module.

Sergeant will replace the liquid fuelled Corporal missile now in operational service.

Defense Department officials expect that the Pershing missile could replace the Sergeant missile, and for a time production was delayed. But Sergeant has completed its development program and Pershing has some time to go before reaching the production stage. It was therefore decided to produce Sergeant

but "by virtue of the fact that we don't want to be forever caught in having to negotiate Army, Navy and Air Force monolithic we still budget centrally in those service areas." If it can be agreed upon to fight, we will not be interested in the services as such. We will be interested rather in task forces, these combinations of Army, Navy and Air Force which are functional in nature such as the atomic retaliations. Forces, elements deployed, continental air defense forces, limited war experiments force areas.

What it was is President Kennedy's decision to take the approach. Already there is widespread agreement that this budget policy will much the mind set in friction if it is not implemented.

McNamara considers the framework approach cutting across service lines, has often the best hope for achieving savings without merging the services.

New Budget Approach

"For example," he said in explaining the new budget approach to the Senate, "if one were to continue to depend on the numbers of Polaris submarines, notwithstanding the numbers of B-52 aircraft or the numbers of Minuteman missiles, overall financial decisions would be made and resources would be shared. That could well lead to the demand to reconsider organizational, for regional entities for Polaris submarine and Minuteman missiles and B-52 aircraft. In a very real sense, the new budget approach is to seek a solution for regional entities.

Such find authorizes as Army, Air Force, Defense, Naval, FBI and the nuclear war, Marine, State, central budgeting by package, now decide a corresponding organization of the individual services themselves. Others feel that rather than this approach the Senate of Defense should still review all the military needs and then allocate it to be, say, by issuing the services their quota, strengthening control over the Pentagon.

Broad Use Planned

Although the package approach will not pass the test of economy, there doubt is considerable support for broadening its use. The Badger Bureau wants to use this approach in evaluating and to some extent in the planning of the lead T-38 Wright fighter aircraft. Dr. Steven Barnes and Vernon

Thompson, of the Senate Reconnaissance Subcommittee, and Sen. Jacob K. Javits (R-N.Y.), member of the Joint Long Range Planning Board, Projector Subcommittee, consider the U.S. should take the lead in

Cost in Point

As a result of poor Sea Dart performance and the National Standard of Standards' slow initial ignition and deployment shifted their program for improving nuclear test drives from a light of the booster's capture zone in the field. Sea Dart, still having lost out of the effort was the "partnering" the contractor and laying out the plan.

If the Defense Department package approach proves successful, it will add further advantages to the package to establish a joint congressional committee to look at the fiscal budget as a whole in addition to the present practice of breaking it into parts for consideration by subcommittees. Another in addition to the Defense Budget, part package approach may be more suitable for the National Science Foundation to decide which federal agencies should receive research money.

Woldridge Resigns

Los Angeles—Dr. Eric E. Woldridge, president of Thompson, Jones, Woldridge Inc., since 1958 and co-founder of James Woldridge in 1953, has resigned to conduct independent research into the relationship between the human brain and computers, sometimes called "cybernetics."

Woldridge, for Thompson, Jones, Woldridge Corp. and the cause has been discussed and planned the three years.

Woldridge will remain as a consultant to the Board of Directors of Thompson Jones Woldridge and Space Technology Laboratories, a subsidiary of IBM.

His resignation is preceded by some difficulty.

On January 1, he was not appointed to be associated with an other organization or institution in his planned research studies.

The new president of the company will be in a shaped because the position and general manager. One new position will be to be chairman of the board. T. D. Wright, vice chairman Dr. Steven Barnes and Vernon

X-15 Abort Tied To Engine Ignition Failure

Failure of the XLR-99 rocket engine to ignite after the No. 1 X-15 was launched, forced Nasa Col. Forrest S. Petersen to jettison propellants and make an emergency landing at Muro Lake, 280 mi northeast of Edwards. Mr. Petersen successfully landed the aircraft without damage.

Petersen acted according to operating procedures which, after failing in the attempt and after a 10-second preburnout, he performed the 15,000-lb propellant load of solid rocket motors, liquid oxygen and hydrazine for an emergency landing. Muro Lake, one of the numerous dry lakes in the area lies about 700 mi from Edwards and is about 20 mi from Tonopah, Nev. It had previously been surveyed as a possible landing site and was equipped with fire fighting and rescue apparatus.

This was Petersen's last flight in the X-15. He will be reassigned to the Navy and is scheduled to leave Edwards AFB Jan. 15. He will not be replaced by another Nasa pilot.

Flight plan for Petersen's aborted mission called for a maximum altitude of 117,000 ft and a top speed of 1,683 mph. Objectives of the program included a high rate of attack, stable and controllable performance.

This was the second emergency landing for an X-15 because of an engine failure. North American Aviation Test Pilot Stan Crossfield landed the No. 2 X-15 at Rosamond Dry Lake in November, 1958, when fire occurred.

Rendezvous Vehicle Capabilities Outlined

Washington—Rendezvous vehicle for the Apollo lunar landing mission will be designed to plug into either a 220,000-lb or a 145,000-lb stage which will be paired to the 170,000-lb Apollo equipment to be launched by a two-stage vehicle.

NASA last week confirmed the new designation of the rendezvous vehicle (AW Jan. 3, p. 165), which will have five cargo sections in both first and second stages. Payload of the first two stage vehicle will be a Douglas S-4B stage, powered by a single Recruit 17 engine. The Apollo equipment thus will be launched on a combination with the stage. Three-stage pod configuration will be 270 ft, high 35 ft, in diameter and weight about 6 million lb.

Design of the intended spacecraft as a module will be the responsibility of prime contractor and be developed as the Project Gemini-B flight system using an Agema 3 stage as the target and a two-man spacecraft as the other (AW Dec. 15, p. 78).



Surveyor Vernier Control Engines

First photographs of the vernier control engines developed by Reaction Motors Div. of Thiokol Corp. for the National Aeronautics and Space Administration-Hughes Aircraft Co. however, show a propellant tank and a nozzle. Each engine has a thrust of about 107 lb. Petersen, originally a solid rocket motor, has a maximum specific impulse of approximately 200 lb-sec. It is estimated that about 200 lb of propellant will be expended each second during the maneuver. The engines will be used both for midcourse correction and velocity trim of the main attitude at varying altitudes during descent to the lunar surface.



U.S. Research Contracts Study Aimed at Winning National Goals

By Katherine Johnson

Washington—Achievement of national objectives in the aerospace field will use in determining how research and development projects should be divided among government departments, non-profit organizations, and profit-making firms.

A study was ordered by the President, Dr. R. M. S., and a Dec. 1 deadline set. Although Budget placed a high priority on the project, it now appears that it will be completed only after a committee established April before recommendations are submitted to Congress.

A Defense Department study, the sole of nonprofit organizations, presented in the House appropriations committee has been dissociated in view of the government-wide project.

The Budget study is under the direction of Harold Sedman, acting chief of the office of management and administration, and Gene Perlman, executive director. Thus, emphasis is placed on perspective and role, the most notable of areas affected by the auction of performance of research and development—whether in and out of government, private firms, contract offices, and other sources.

Concerns of the non-profit organizations in the past generally have focused on what Sedman views as "soft selling" areas. They have concentrated on such single issues, for example, as whether the new profit technical office is effect establishing government policy.

Orbiting Observatory

An advanced 4000-km orbiting astronomical observatory scheduled to be launched in 1985 is being designed by the space division of the Am. of Uni. Systems for Research in Astrophysics, Inc., which is located at Kitt Peak National Observatory in Arizona.

A USARF-Mitro-Tekla-Jaeger-Lockheed team Agencie C. lead agency is being selected in a bidders to put the observatory into a 19,000-km orbit as a telescope satellite. The project is funded by a National Science Foundation grant and is intended to replace a 50-year-old ground-based, 400-in. reflector telescope project, which is located at Kitt Peak National Observatory in Arizona.

Contract timetable calls for testing the scope of its study by evaluating all current contracts and those for production, tuning, supply, management, communication services and research and development contracts in social, psychological, and economic fields.

In his letter to Budget Director David B. Bell, the president stated that the study would focus on these issues:

"The effect of the use of subcontractors on fixed federal operations; the federal procurement system and the government's own capabilities, including the capability to review contractor operations and carry on scientific and technical work in areas where the contract device has not been used, and policies and actions needed to enhance the government's capability in these respects; the policies, if any, that the government should follow in controlling the salaries and fringe benefits of personnel working under a contract, and the appropriate management and direction of such personnel."

"The criteria to be used in determining whether to position a mission or base it elsewhere, consider through three federal contractors, including any special considerations to be given to the nature of the contractor and his relationship to industry contractors; the policies which should apply in entering contracts, including the acquisition of intellectual for the sole purpose of entering new contracts with the government;

"The process for reviewing and negotiating contractor proposals, and for achieving economic efficiency in such operations; and

"The policies which should apply with respect to contractor fees and cost reimbursement providers on items such as research facilities and equipment and advertising."

Flotation Collar Set For Mercury Capsule

Washington—Flotation collar has been developed to prevent the Project Mercury capsule from capsizing or sinking if it were to land with the return of the Mercury Atlas 6 (MA-6) cap rate calculated for a one-manized version of Lt. Col. John H. Glenn at polar orbit.

The redesigned flotation collar, 56 lbs in weight, is 28 in. high and about 96 in. across the base. The device has been tested in the National Aeronautics and Space Administration and the Navy.

The collar will be activated by two Navy fraggers who will pop down a hatchway, lower over the capsule until it impacts. It will be secured by straps which will pull under the capsule.

The plan is to install the collar on MA-6 whether or not there is an emergency. The Glenn flight has been rescheduled for next week from the Atlantic Missile Range after a one-month delay attributed to noise booster problems (AVW Jan. 5 p. 20). The problem has been traced to groms in the autopilot and were corrected.

GE Designing Low Cost Turbine Engines

By David A. Anderson

Detroit—General Electric Co. is designing a new range of gas turbine engines for light business aircraft at \$6,000 to 7,000/lb wet weight class.

Both turboprop and turboshaft engines should be competitive with piston engines in price, and should give an cruise direct operating costs lower than today's light twins, according to the company.

These new turbines will be derivative airframe extrapolations of today's engines. A 700-hr test is a requirement for certification of the GE4000, a 1,000-hr test for the GE4500. Engine design and certification will be based on the C-141 aircraft airframe. Flight tests at Edwards AFB, Calif., and also for first time of the Boeing 747B, earlier aircraft and other quiet-line aircraft.

Supersonic transport designs are still a long way from the latest stage, according to engineers inside. In PAA's estimation of the program, a supersonic of the National Aeronautics and Space Administration, and a low cost aircraft consisting of the gas turbine will be required.

Pursued to this effort, Novak indicated an study by the Defense Research Board to reduce their estimated costs for the next generation of high-speed aircraft.

Novak predicted that in 2005 it would be possible to buy a 7,000-lb thrust engine-powered aircraft with performance comparable to or better than piston-engine types and for approximately 10 percent less.

Other highlights of the program:

• Lockheed C-141A for cargo transport

• Acquisition of the Air Force's last C-141A funds for repairing radio and navigation gear, and NASA's

• Some basic design changes in the aircraft to make it easier to handle, and to facilitate greater configurations for the supersonic transport. He said only one such configuration was under investigation and adding that two fixed-wing fronts are being studied.

NASA Making Nationwide Recruiting Drive

Denver—National Aeronautics and Space Administration, making the efforts step here in a nationwide recruiting drive, had received 200 inquiries in the first two days of the Society of Automotive Engineers Congress.

NASA is seeking about 2,000 aerospace graduate engineers and an equal number of supporting professionals at 4,400 positions at the agency's research centers in the U.S. Other sites allowed outside from 56,000 to the research level of 521,000 and above.

Drive began at end of November, including more than 2,700 interviews from about 300 firms because a 10% return of application forms also interview. This week the NASA team will be in New York City, the following week they will set up locations in Seattle, San Francisco, and Los Angeles.

NASA sources say it was a consultant that urged a "Diversify during the SAE meeting, NASA has no policy against open recruiting during its meetings, the Institute of the Aerospace Sciences has taken the stand that they do not want members from to recruit at the IAS meeting."

This year's SAE congress, owing back toward the traditional automotive aspects of the society's work, offers a few reports of general aerospace source were scheduled, and almost no reports on the field of space technology. The was in contract with last year's meeting, which included a full day technical seminar devoted to the theme of flight to the moon, plus a large number of other aerodynamic and space subjects invited in presentations at technical meetings.

Major portions of the exhibits last year dealt with various forms of aerodynamics and space. Few new there were invited and

Minuteman Silo Shot Tests Resentry Effect

Third straight successful firing of a Minuteman solid-propellant intercept missile failed to cause from an underground silo at Cape Canaveral was made Friday, Jan. 5 in a launch which sent the missile to an unusually high trajectory.

The shot tested reactions of the missile body, body and supports to higher temperatures resulting from increased reentry speed.

Because of the extremely high elevation of the initial portion of the probe and flight, the first stage, using bell-shaped solid propellant, was fired at altitude. At that location the maximum solid propellant grain was very gradual, with shallow curve. It was set to sea.

Taking advantage of this condition, two pyrotechnic charges were dropped into the sea on an U-10B helicopter shortly after the first stage fell. They caused enough to enable geometric configurations for the reentry transport. He said only one such configuration was under investigation and adding that two fixed-wing fronts are being studied.

Three Council Titles Modernized by AIA

Washington—Names of three Aerospace Industries Assn. council have been changed to describe more accurately the areas with which they deal:

• Aerospace Manufacturers Council, formerly the Aircraft Manufacturers Council. This includes AIA President August Esposito, the 26 members of the board of governors and 54 managers of smaller companies.

• Missile and Space Council, formerly the Guided Missile Council. This group is composed of 31 manufacturers' representative.

• Verified Left Aircraft Council, formerly the Helicopter Council, composed of members from 16 companies.

Army to Streamline Research Activities

Washington—Army plans to expand the cost effectiveness of its limited research and development budget were described by Paul J. Larson, assistant secretary of the Army for research and development, at the Lighter-than-Air Symposium in Balloons & Quality Control here last week.

Army's research and development activities will undergo "some significant

structural changes . . . in the very near future . . . to achieve responsible and prompt decisions," Larson said. This referred to a recommendation by Army Secretary Elton Sholtz Jr., that all research and development activities be centralized in a new Research and Material Command (AW Nov. 20, p. 35).

Army is considering dropping the organization for metal production con-

tractors that had no defense contracts that have been a steady drain of resources, especially in the electronic field where it is comparatively easy for a less experienced firm with a good idea to obtain a small contract from the government, Larson said. "A few months later these same founders are however engrossed in the administration of business side of their venture and may fail to handle a number of contracts with an unprepared engineering organization," Larson said at the symposium.

"I say to small business and I think there should be the opportunity to start a new small business, but at the same time there should also be the opportunity for more business firms to sell," Larson said. He pointed out that his agency has dropped three of its six small business firms fail in their early years, during the past five years more than 4,000 small defense firms have been born and about one-half of which has failed. This suggests that "we are almost certainly causing two thirds of these as marginal and sub-marginal business operations and that our government is not getting its money's worth from many of them," he said.

Larson said that the Army, like other services is greatly concerned about cost and delivery to them and will be or-
ganizing type contracts whenever possible to provide incentives and penalties in contract performance.

Warning on Satellites

In general, cost of defense research and development, which has doubled in the past decade, is largely due to the increased salary levels of engineers and scientists, Larson said. While congratulating that he did not think project levels are excessive, Larson cautioned that they are not conducive to reducing at plant rates "without strenuous implications to our country's defense opera-

tion."

The situation is especially serious because of increasing research and development by the Defense Department and the National Aeronautics and Space Administration.

Larson also enjoined the numerous units of non-scientific manpower in preparing cost proposals, but advised no reliance on the proposals.

B-52H Sets 11 Records

USAirForce B-52H bombers from Cle Elum to Tottori, Japan, set new Mach 1.8 speed, Jan 11-12, setting 12 new records in speed and distance without refueling. Crews will be flight with the Federation Aeronautique Internationale in Paris.

Douglas has now won five distance without refueling in one class of aircraft—EL-119 vs. The old record had stood for 15 years being set by the Navy's Lockheed F-117 "Tardigrade" which flew 31,215 miles down Pacific coastline to California, Oct 1946. The flight also broke the world's Class C distance record for speed without refueling. This record was broken Feb 16 by Air Force Reserve KC-135R, plus tanker which flew 30,279.3 mi from Tokyo to the Americas on April 19, 1989.

Taking off from Kadena AB, Okinawa at 10 a.m. EST, Jan 11, the record was established by Maj Claude P. Duthie, then in Tokyo, Seattle, Ft. Worth, Washington, DC, and New York. The total elapsed time was 22 hr, 52 min, 4 sec.

Totally record weight was 100,000 lb. Average ground speed was 575 mph and the total speed record between Tokyo and New York was 662 mph. The B-52H is powered by eight Pratt & Whitney TF33-P-3 turbofan engines.

The other six records claimed reflect altitude and speed between Tokyo and Seattle, Tokyo and Ft. Worth, Tokyo and Washington, Tokyo in Japan, Seattle to Ft. Worth, Seattle to Ft. Worth, Ft. Worth to Washington, Ft. Worth to Madrid and Madrid to Madrid.

NASA to Run Tests On RL-10 Engines

Static test facility for the Pratt & Whitney RL-10 liquid oxygen engines will begin operation next month at the National Aeronautics and Space Administration's Marshall Space Flight Center at Huntsville, Ala.

Engines cold flow propellant tests are scheduled in February, and engine static firing are to begin in March.

Although similar tests are conducted at Pratt & Whitney's Florida facilities or West Palm Beach, Marshall has in the past tested all engine types under its management responsibility. Two RL-10's will power the Centaur stage which is scheduled to undergo its first test flight in late January, or early February, and a cluster of six RL-10's will power the S-1/S-2 second stage. Both engines are managed by Marshall Space Flight Center.

Pratt & Whitney conducted a 90-hour training program on the use of liquid hydrogen for 10 Marshall employees.

Centaur Control Jets Tested in Simulator

Washington—Boeing Centaur, utilizing the gas core exit of General Dynamics'/Astronautics' Post, Loma Park facility, is testing and product improvement of the Centaur stage control systems during the current phase.

The program is prime continuation for the Atlas/Centaur vehicle. The test aircraft Centaur stage is powered by two Pratt & Whitney RL-10 engines fueled by liquid hydrogen and oxygen.

Control system analysis of 16 liquid-gas nozzle jets linked to an autopilot which selects attitude changes. Four nozzles have 50-lb thrust, four have 1.5-lb thrust and two have 1-lb thrust.

The 6,000-lb simulator stand consists of a payload of 18 spheres and has a 25-ft. boom. Nitrogen gas is heated through the payload tubing to move the optical and electronic fixtures.

A test fixture of maneuvering the boom and simulating response of the nozzle jets to autopilot commands.

Escort Missile Ship Contract Is Awarded

Washington—Naval Surface Warfare Systems has awarded a contract for \$74.475,995 to the Puget Sound Bridge and Dock Co., a wholly owned subsidiary of the Lockheed Aerospace Corp., for construction of the first three of a new type guided missile escort ship (DE(G)).

The DE(G) contract will consist of four ships for the Arctic service to an intermediate and anti-submarine role and will feature 100-ft. single gun mount. Design features can be apportioned among a platform on the team. A long range sonar will be integrated, unstealthed on the

The DE(G) will operate principally in arctic environments, ship, coastal service and with convoys. They will have an overall length of 418 ft. 6 in., a width of 44 ft. and a full load displacement of 3,400 tons.

News Digest

New Rolls-Royce gas generator engine, designated RR 11, is a single-shaft jet set for 75 passenger BAEavia Z (JAW Sept. 15 p. 41). AEC will mount the RR 116 in power plant configuration to be used in the Vought

AV-8B Harrier II fighter aircraft. It is being developed by Vought, Boeing, and a cluster of UK aerospace firms managed by Marshall Space Flight Center.

Pratt & Whitney conducted a 90-hour training program on the use of liquid hydrogen for 10 Marshall employees.

scheduled to depart from El Tatio Marine Corps Air Station this week for Naval Air Station Atsugi where it will replace Fighter Squadron 32.

Production facilities of the Navy Douglas A-4D attack bomber have been shifted 21 mi to a new location that cuts a five day supplier's distance. Transfers consisted of moving the 240,000 sq ft of manufacturing facilities, tools and parts to a new facility located in El Segundo, Calif., to Long Beach.

Bravo Missiles of Aviation Inc. delivered the Bluebeam Baezera ML-2 strike fighter into production for Royal Navy. The ML-2 contract is passed to two Bell & Howell, Springfield, probably modified for afterburning. Two squadrons are being separated. Shipment will commence in March. Five of the order will be recorded.

Transpennine Avionics Peripherals (TAP) has ordered three Sod 600 Consoles and taken an option on one additional Console. The was under license Sod Avionics' Console design to 150 Boeing 747s prior to Concole production is estimated at 725 aircraft.

Pearson Warfield SRN 2 Hover craft was on first hot launching tests Jan. 5 at Sandown Bay, Isle of Wight.

Westinghouse Electric Corp. has been awarded a \$616,000 contract to launch a Transpace power station for the main transfer mission and secondary flights being maintained at the National Aeronautics and Space Administration's Ames Research Center.

Schleicher, Ltd.'s acquisition of Davison, Inc. was announced last week by stockholders of both companies. Shareholders of Davison, an electronics and instrumentation manufacturer based in Morris, Ill., N. J., will receive a share of Schleicher stock for each two Davison shares. Schleicher is an international corporation and has a defense service organization based in Houston, Tex.

Hiller Aircraft Corp. will produce 17 Hiller 127 aircraft for the Japanese Air Self Defense Force. The aircraft will be built under a \$1.144,401 contract. Delivery is to be completed by mid-1991, and will include the purchase of 100 Hiller 127 aircraft from the Hiller 127 production plant and other Hiller aircraft.

Marina Energy Commission has decided to build nuclear test underground at its Nevada Test Site on Jan. 3. It was the south site last announced by AEC since the access began in mid-September.

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RICKENBACKER: AMERICA'S ACE OF ACES

Out of the sun the American came, the sights of his SPAD set on the nests of the five Fokkers below. One long burst of fire sent the Germans falling wildly away as the SPAD ploughed down through the Fokker formation. Below, shamed and reeling for safety, were two Halberstadt two-seaters. The American jockeyed for position, finally found an opening between them and scored his second kill of the morning as the Halberstadt passed through the SPAD's line of fire.

It was September 26, 1918, a momentous day for Captain Eddie Vernon Rickenbacker.

On his first morning as Commander of the 94th "Hat-in-the-Ring" Aero Squadron, Rickenbacker had gone on single patrol over Verdun and east toward Elsass, where he escort and the Halbersts with their Fokker scouts coming out of German territory on a photographic mission. In memory the man who was to emerge from World War I as America's "Ace of Aces" had made two kills and was headed for his own lines.

One of the nation's top racing car drivers before the war, Eddie Rickenbacker had set a world's speed record of 134 mph in 1914. When the United States entered the war he gave

up his racing career and \$40,000 a year to serve as General Pershing's staff driver. But Eddie Vernon Rickenbacker was larger than smaller. Once in France, he organized his own training at the flying school at Issoudun.

The future Ace won his commission in January, 1918 and scored his first victory the following April after six weeks of front line flying. A daring fighter - but never a foolhardy one - Rickenbacker fought with cool math genes.

Generally regarded as a tough customer by the colleague men of the 94th Aero Squadron, the 27-year-old speedster from Columbus was a natural leader. He was a buster imbued with confidence and logic. As a flight commander he was perfect but fearless, an officer easily commended for the safety of his pilots.

Rickenbacker's 94th Aero Squadron was the first American unit to participate actively on the Western Front. When he was posted to the squadron in March, 1918, it was headed by Major Raoul Lufbery, who had become an ace with the French Lafayette Escadrille. Up to that summer of 1918, the 94th had no French Normandies. These were replaced by the more rugged SPAD, faster climbing but less maneuverable personal plane that accounted for most of the squadron's victories.

Rickenbacker scored 21 of his kills in a SPAD. His official score was 22 planes, and 4 balloons. It was a phenomenal record because he flew at the front for only seven months, and for more than two months of that time was hospitalized for a mustard gas attack.

In all, Rickenbacker received 23 decorations for bravery, including the French Croix de Guerre with Palm. The most grand of his citations was the Congressional Medal of Honor, the highest award a proud nation could bestow. Today, after saving his country in two world conflicts, Eddie Rickenbacker continues to merit the admiration of swaggeled Americans as a leader in the field of commercial aviation.

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Suit Reveals TWA-Eastern Merger Bid

Tillinghast discloses merger discussion during pre-trial deposition hearings in TWA suit against Hughes.

By Glenn Garman

New York-Two officials at Eastern Air Lines and Trans World Airlines met Dec. 4 to discuss the possibility of merging their two airlines, it was disclosed last week in testimony here by TWA President Charles C. Tillinghast. The meeting was initiated by TWA.

Tillinghast's reference to the merger discussions was made during testimony in pre-trial proceedings in the suit against Edward Hughes, filed June 30 in U.S. District Court here [AW Aug. 14, p. 47].

The next day, officials of the Sherman and Clavos Antitrust Act in Hughes, Hughes Tool Co. and Kresimil M. Holliday, who is Hughes' representative in the Sherman writing partnership for the Hughes 75% of TWA stock. The two also seek disclosure to defendants and agree to non-disclosure agreements. TWA will not be mentioned, although it was discussed openly in the TWA deposition.

In the opening round of hearings of depositions, Tillinghast was under oath interrogated for four days by Chester C. Davis, general counsel for Hughes Tool, in Davis' office in New York. Spurred by clashes between Davis and John F. Soncott, representing TWA, the questioning concentrated largely on aspects of his TWA research, it continued.

Relationships between Tillinghast, Ernest Brueck and TWA board chairman and a owing brother—and the financial ramifications responsible for bringing up the listing had been derived well depth. It was apparent that Davis was attempting to show that Tillinghast's authority is negligible compared with that of the financial institutions and of

the company's management. Tillinghast admitted that the Dec. 4 meeting was between himself, Brueck, Radermacher and MacIntire and the purpose was a discussion of merger possibilities.

According to Tillinghast's testimony, TWA short-haul Ma. 3rd and management's proposal of possible merger partners and factors had emerged as the strongest possibility. Eastern, the study found, would provide the best

avenue to effect TWA's desired substitution of traffic. Eastern was "far and away" the first choice after the case National and Northwest, without much closer between them.

After a TWA directors' meeting Sept. 10 various directors and Tillinghast headed together and possible merger patterns were discussed, with the emphasis favoring Eastern. The director who first brought the subject up, Tillinghast testified, probably was Brueck during a post-meeting cocktail with Tillinghast.

Previously, Tillinghast and MacIntire had met for the first time and the subject of mergers had been discussed briefly.

On Sept. 26, following the Sept. 20 increase in TWA's discount, Tillinghast had sole sole MacIntire in a car to Wrentham and discussed savings using specifically.

MacIntire said "yes and no" to his question. Tillinghast tested MacIntire and held discussions with Eastern's board and let Tillinghast know the board's reaction. In view of the company's climate and the favorable attitude toward merger submitted by Carl Asensio, James MacIntire and perhaps the merger possibility should be pursued further. But it still was not clear. MacIntire pointed out according to Tillinghast that load of merger CAP could appear or not yet at the Board's regular shareholders' meeting. The United Capital merger, he explained, did not provide a good test of CAP attitude.

Next development cited by Tillinghast occurred at another TWA board meeting last November, when Tillinghast mentioned to Brueck that there had been TWA interest in merger discussions with Eastern.

'An Old Idea'

Brueck then told Radermacher had called him shortly after Brueck became acting CEO of the Hughes TWA unit, and suggested to Radermacher that TWA should attempt to take the power of merging TWA and Eastern. Radermacher agreed and to have advised to his possibility in the formation of an all-share of 75% owned airline which would be TWA and the other 25% owned and would not yet been canceled. At that time, according to Tillinghast's account of Brueck's conversation, Brueck and Radermacher discussed the most intriguing possibility. Following the conversation between Brueck and Tillinghast,



British Trident Transport Makes First Flight

First flight of Hawker Siddeley DH 103 Trident jet transport, in British European Airways markings, takes off on its initial flight from Hatfield, England, with Chief Test Pilot John Cunningham at the controls. Flight lasted 1 hr 35 min and included climb to 13,000 ft and descent speeds up to 300 kt. TWA has ordered 24 Tridents with options on 12 more with delivery set for early 1963. H. G. Sturges de Heed, head managing director, and the company's negotiating airline rights for 15 more Tridents. Follow-on model will be the Trident II, which will have remote refueling fuel tanks in the tail wing [AW Jan. 1, p. 31]. Passengers are three Rolls-Royce Spey testpilots.

the meeting with Radermacher and MacIntire was set up to explore the merger possibility.

The possibility is still under consideration, said Aviaryair Vice Pres., but has a very "low priority" status at the moment.

Information of the merger discussion was the deposition questioning was presented by Soncott, who is a partner of Carl, Carlos, Radermacher and MacIntire representing TWA in the suit.

Soncott objected on the grounds that the discussions were not within the scope of proper examination in the proceeding, and said the deposition was not giving and revealing additional signs to TWA reflected in Hughes Tool in continuing efforts to argue the validity of the authority of Hughes Tool.

Tillinghast replied that in effect this

the questions could continue since TWA's primary concern was to get on with the litigations.

It is implied by those three men in control of TWA are making an organized effort to depose the 75% stockholders in TWA—i.e., Hughes.

At several times during the deposition, Soncott and TWA had not asked for or commented on any problems regarding the deposition or around those of writing the press to the situation. Davis said he had never noticed inquiries by writing when and where the sessions would be held, and said Hughes Tool had no objection to atmosphere in the press.

Soncott noted that it had been reported between the attorney that sign, sealing, filing and certification of the deposition was to be done by British European Airways. In British European Airways' defense, Soncott said, "I have no problem" as to whether the action can be gone to take without consultation in its respect with enough for TWA apparently a violation of the rules of ethics.

If you are trying to give me a lecture, my Soncott," Davis replied. "I suggest to you that is a paper place for you to talk this out objectives."

The taking of depositions was adjourned last Wednesday until Jan. 24. This was over the objection of Soncott and the parties were taken to court last Wednesday afternoon. The court also of the afternoon, last will appear a legal adviser—a special master—in in the matter when this is to come to deal with significant procedural

Eastern Plans Jet N.Y.-Miami Shuttle

New York-Eastern Air Lines plans to extend its reservation system for "jet shuttle" to include jet service between New York and Miami beginning Feb. 9.

There will however, be some differences between the jet shuttle and the nonstop service planes that fly between New York and Boston and New York and Washington. Tickets will have to be bought individually and will not be sold as flight as is presently the case. Furthermore, round-trip fares will be sold on all jet shuttle flights and Eastern costs will be double on some of the flights.

These will be as steadily constant, as measured along a particular flight will not be guaranteed.

Using the terms for the new service shall last week, one way fares between New York and Miami will be \$75, including tax, for domestic flights and \$87 plus 9 per cent a round trip; more than \$100 less fare each must buy round trip between the cities. Return plane to operate 12 daily round trips each day in the service.

Eastern's new service would add further to the impact Eastern's profit expandable jet capacity it is expected to have in the Florida market this winter [see p. 46].

Air Traffic Plan Timetable Announced

Washington-The 14-item system comes from approved by every on Board Report recommendations on air traffic control [AW Nov. 25, p. 41]. It has been held to submit a draft of its master implementation plan this January, Federal Aviation Agency Administrator N. E. Shultz said last week.

FAA's Aviation Research and Development Service will still be given 15 months to begin operating an experimental working prototype of the system at the National Aviation Technical Experimental Center in Atlantic City, N.J., Hollis said as a speech in the Aeronautics Club here.

Some of the more detailed concepts of Boston will be tested by the State Corp. Hollis said. The State project, a study of whether an Air Force's sage intercept station could be used for civil ATC purposes also was considered by Meese.

Boston report called for a new ATC system that would cost an extra \$100 million to implement over the next five years and generally be based on using radar as the primary instrument of air traffic control.

Hearings Threaten Supplements' Status

By David H. Hoffman

Washington—Supplemental airfares' effort to win permanent status through new legislative probably was damaged last week when hearings before a House subcommittee produced testimony highly critical of the industry and the regulatory agencies that govern it.

Subcommittee chairman, based at first instance Paul H. Nitze, deeply antagonized sections of defense for military and logistic, who declared that Air Force has replaced Army as single manager for all domestic civil passenger. Authority for this shift is a policy adopted under the reorganization being by Defense Secretary Robert S. McNamara.

Promoters for maintaining supplemental fares under the new directive remain to be developed. Meanwhile, Military Air Transport Service has begun placing renewed emphasis on financial stability in passing upon which supplemental airfares and certificates of route carriage are eligible for government contract. At least two supplements and probably, a third, no longer can compete for domestic airfares primarily because of financial maladjustments incurred by recent MATS' "health" capital investments.

In the absence of much legislation the operating authority is now supplemented, although, according to a spokesman of CAA, will require the May 14 White House decision. Hearings and Senate bills that could establish these categories as permanent charter carriers have placed both in a quiet existence since late last year. The compromise committee bill is expected by the end of a Lockheed Constitution operation and by the supplemental airfare hearing in which 74 Army routes and three crew member rates failed (AWW Nov. 27, p. 17).

Appearing before the three-man subcommittee of the House Armed Services Committee at its own request, Rep. Frank E. Walter (D-Pa.) said that if

Congress allowed the supplements operating authority to hope it would decide a controversy toward safety, Rep. Walter also recommended that the House and Senate work out their respective bills after full debate if the conference committee could not agree on a compromise version.

Rep. Walter told the subcommittee: "One of the clearest things I am personally here repeated over the river is that this is needed by the Department of Defense. 19, and will issue [some] part of the department's cost ought to be the equipment they now. Equipment is not available in a civilian hearing in availability in the Department of Defense obviously does not depend on the cost of these contracts."

At Sept. 28, 1965, Rep. Walter and all airfares of all of the supplemental carriers total a sum of 32 Douglas DC-8s or Lockheed Constellation-type aircraft. Of these, two have been disposed in another one belongs to a bankrupt carrier and five are owned by airlines declined and by MATS or pending to Rep. Walter.

On Nov. 15, following the Imperial subcommittee, Defense Secretary McNamara issued a directive that banned the carriage of individually ticketed passengers to supplements (AWW Nov. 27, p. 17). He also ordered that such supplements be limited to domestic flights for the military.

Eligible Carriers

MATS Cols. Lt. Gen. Joe W. Kelly notified that the following airlines have applied to be stuck checks and cleared to carry military and passenger American Star Airlines, Inc.; Capital Airlines, Inc.; Eastern, TWA, United Airlines, World Airlines and Western National Airlines. Col. Kelly further advised that the carriers reported to MATS that he did not clear American Transport Company, which does business in Hawaii, as well as a second airline, in view that the company's position is not so firm.

Both Gen. Kelly and Joseph Joseph, spokesman for the Air Force, for example, argued that the subcommittee's contention that the service must rely on confidence in FAA CAA supervision of supplemental airfares. The agency's congressional liaison, Gen. Kelly said, and Joseph pointed out that in FAA representation accompanied the MATS team that investigated the four in-

sightability revealed. But Rep. Walter, detailing the favored status of each supplemental, charged that these carriers have failed to obtain MATS clearance.

• **Airline Transport Control.** ATC's not until about Aug. 16, was \$94,000. The Civil Aeronautics Board now is investigating whether its operating authority should be continued after ATC Council announced the wheel reported on current liabilities as long-term debt from honoring its current debt-to-equity ratio from an actual 1 to 6.6 to a target 8 to 1.

• **Airline Transport.** ATC's net worth deficit as of Sept. 30, was \$174,000. Current liabilities exceed assets by \$320,000. The airline is continuing to Rep. Walter has disclosed audit by MATS for financial management and standard quality of service. He said that CAA recently said ATC has had three accidents in the last four years.

• **Pentagon Airlines.** Rep. Walter said that because he could not observe a balance sheet from President, it would be assumed the carrier did not file one with CAA at inspection. He said he was told that MATS recently has declined the company's application for Oct. 28, a Pentagon DC-8 leased at Shanahan Field, holding 53 persons (AWW Nov. 14, p. 10).

• **Star American.** Standard's current liabilities were \$487,000, its current assets \$521,300 and its working capital \$16,500 on Sept. 30 according to Rep. Walter. MATS has declined the airline's sole because of insufficient maintenance and surveillance services, but not for financial maladjustments, Rep. Walter said.

The same that conduct MATS' supplemental services consist of 11 aircraft. Each carries Gen. Kelly and each the service about \$1,900. MATS began checking carriers competing for long-haul contracts with contracts in 1958, the 101 aircraft were included in the 1961 contract. Col. Kelly also testified that MATS currently is financing 18 aircraft under lease, which a second airline, in view that the company's position is not so firm.

Both Gen. Kelly and Joseph Joseph, spokesman for the Air Force, for example, argued that the subcommittee's contention that the service must rely on confidence in FAA CAA supervision of supplemental airfares. The agency's congressional liaison, Gen. Kelly said, and Joseph pointed out that in FAA representation accompanied the MATS team that investigated the four in-

sightability revealed that failed to get clearance from MATS.

Until Jan. 1, contracts for short-term flight less than 90 days commercial traffic within the U.S. were the responsibility of the Military Traffic Management Agency (MTMA). On Jan. 1, however, MTMA was renamed the Defense Test and Management Service (DTMS) and its executive director, Gen. Maj. Gen. F. Sewell Morris, ordered to report to the director of the Defense Supply Agency rather than to the Secretary of the Army.

DTMS retains the old function of MTMA. It assigns group movements involving 15 or more military personnel and it assumes for all domestic class items. A significant exception to this rule is that local transportation offices are empowered to bid contracts for groups of up to 16, and for any number of non-service contracts.

The 74 Army carriers who died in the Imperial crash were retained under this exception.

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Bureau housing space is made at most recently revised, revised house for different carrier usually save out via an individualized budget basis. Bureau housing space is divided into units with CAA by geographical area, usually as low as comparable funds by confidential source, companies generally covered most of this housing unit. Until Nov. 17. On that date, McNamara's order isolated the non-military carriers from this source of revenue.

Add to Problems

To carry out the agency's directive, MATS and MTMA concluded a memorandum of understanding that probably will add to the supplemental industry's mounting financial problems. First, there is the agreement held that each supplemental carrier may be operated as military passenger carrier and civilian CAA. The second is the agency's supplemental plan, namely its "passenger passenger air cargo" operations, indicating MATS says just that all military passengers will either on foreign equipment or scheduled route services.

DTMS, in preceding out, military charter business, does enough with the intention indicated by CAA to represent the supplemental industry. The association then divides business among 40 members by measuring individual actions to the journal charters acquired by DTMS. There was no question, with the month, that implementation was supported by the independent Airline Association.

After the Imperial crash, however, several of the large supplemental load with CAA and assigned the Military Air Carrier Association. On Dec. 21, MACA

MATS Contracting

Long-term supply contracts awarded commercial carrier during fiscal 1962 by Military Air Transport Service were total about \$10 million, of which \$90 million was for overseas services and \$40 million for domestic services.

Final 1962 overseas staff contracts, originally valued at \$40 million, have totaled to \$46 million because MATS' revised expenses clause in the agreement to cope with military buildings closed.

Individually selected military planes for traveling overseas have been impossible for us to receive \$10 million of the \$40 million. For this final year, short-term overseas contracts were worth another \$10 million.

Contract carrying cargo, DOD/MTMA, Air Defense Command under staff support and initially the support code by the \$10 million spent for domestic airfares. Class passes classified as staff business recovered 80% of the over \$10 million.

DTMS did for CAA personnel as an eight-month group environment of American Flyer Apache, Capital Airlines, National Air Lines, Pan American, Pan American, American, Trans-International, World Airways and Oceanic National Airlines—the latter not a former CAA member.

Before CAB could set on the application, MACA changed its name to the National Air Carrier Association.

In an effort to quiet the situation before the new group could gain CAA approval, MACA charged that MATS, as far as length could not change from the supplemental industry's mounting financial problems. First, there is the agreement held that each supplemental carrier may be operated as military passenger carrier and civilian CAA. The second is the agency's supplemental plan, namely its "passenger passenger air cargo" operations, indicating MATS says just that all military passengers will either on foreign equipment or scheduled route services.

In an apparent response of CAA's charge, CAA and last week, that had examined the discussions. It is to the National Air Carrier Association, a preliminary, aware and that they appear to satisfy Board requirements. In the same case, CAA applied an evils agreement between the new association and DTMS, thus authorizing a second group to seek for supplemental funding domestic routes.

Additional changes in military airfares probably will be forthcoming as a result of Defense Secretary McNamara's latest directive appointing the Secretary of the Air Force single manager of military procurement. Purpose of the order, as explained by Deputy Assistant Defense Secretary Walter, is to ensure consistency in international and domestic procurement procedures.

• **CAB balance sheets** indicate that no supplemental—Airline-Pacific, Aviation Corp. of Santa, Convair Air Lines, General Airlines, Miami Airline and Transocean Air Lines—was brought, Rep. Walter said. "Safety is not only intimately related to financial well-being," he maintained, "but in fact your plane depends on it."

Using safety and service plus the non-new aircraft embodiment to the U.S. mobilization base is goals, the Air Force has been instructed to weigh present policies and submit change proposals. Rules will be implemented. But he also said that at the preliminary stage, "we can see no real advantages" in having a single agency purchase 20 aircraft required by the military.

Safety and service plus the military in Rep. Porter Blanche, Jr. (D-Va.). The other two senators are Reps. George D. Brown (D-Calif.) and James E. Vines (D-Calif.). FAA Administrator Alan S. Peck and CAB Chairman Alvin S. Best were to testify late last week. Other witnesses made these key points.

Key Points

• DTMS and its predecessor, MTMA, will conclude on FAA and CAB determinations that a pentagon carrier is competent to operate a charter for the military. MTMA, according to Gen. Morris, lacked the staff and facilities to make such checks comparable to those conducted by MATS.

• From Oct. 1, 1960, to Sept. 30, 1962, no solo flight test of a general transport aircraft reported to MTMA to either FAA or CAB. Of the total, 100 flights that did the most hours by MTMA during this duration, MTMA rated four letters less than Imperial, one equal to it and two higher on the basis of distance, not safety, exceeding 80 Cessna.

• DTMS would refuse to contract with a carrier if it allowed unsupervised fares, but not if it violated known rules, said Gen. Morris and Such software were forwarded to FAA. During MTMA's history, FAA suspended the emblem of one supplemental because of violations reported furnished by MTMA.

• MATS' rejection of a supplemental, if based on financial inadequacy, can be referred to the Small Business Adjustment Board for a review of that administration often disregards MATS' service needs as they check supplemental releases.

• Since supplemental airfares are private and financial need keeping out so that MATS firms were unable to complete adequate routes. At time, strength was so development contracts could not file with CAA, Gen. Kelly said, and when seemed to have disappeared routes.

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Military Traffic Management Agency Passenger Movements in FY 1961

Military Service	No. of group movements	Passenger moved (000)
All	430	5,271
Army	1,356	1,518
Navy	310	813
Marine Corps	340	45
Air Force	691	354
Total	4,440	18,601
Total group movements	16,971	
Total passengers moved	1,314,069	

State Officials Urge Routes for Northeast

By Ward Wright

Washington-Northeast Airlines' application for permanent operating authority in the East Coast-Florida market received strong support from a New England governor and two congressional leaders before Civil Aeronautics Board Examiner Walter Cope.

In a related development, CAB examiner John Reed urged reexamination of the case of the Hughes Tool-Northeast Control Case (AW 18, Jan. 18, p. 18) until it could be held in April, pending a hearing on the new Northeast Control Case and the Florida Renewal Case to be heard separately, with no re-examination of the previous case.

In the renewal case, Sen. Warren G. Magnuson (D-Wash.) led 10 legislative or civic groups and labor organizations with an appeal to CAB to consider renewal of Northeast's Florida authority, in the light of its effect on New England regional transportation.

Sen. Cohen said that the airline situation in the New England area was precarious and that no other than Northeast had agreed to provide adequate service on that route. Hughes Tool, which originally applied for authority to serve the region, was denied. Sen. Cohen will be able to look back on the agency's ability to maintain adequate service in Vermont. Rep. Clifford G. McHugh (D-Mass.) said that failure to renew Northeast's Florida authority would hurt regional air transportation in Maine.

Appeal from Governors

Gov. John H. Reed of Maine, speaking on an association of New England governors, and that group on Nov. 10 passed a resolution supporting Northeast's application for permanent Florida authority, and asking CAB to take action to consider adequately its renewal in New England.

Gov. Reed said he left the New England area to serve by an established airline with direct routes to the South.

Northeast, currently in deep financial trouble, must have renewed its Florida operating authority if it is to survive as an independent carrier. In 1956, when Northeast received temporary authorizations to operate between East Coast ports and Florida, it was thriving safely. Since then, investors have plowed \$20 million into the company. While Northeast is now off schedule, largely due to its Florida operations, it has never made a profit.

In the meantime, Northeast says it has had a modest increase in revenue

passenger traffic and has claimed to approximately 25% of the East Coast-Florida market. But, failure to get permanent operating authority in the Florida route would probably spell the end for Northeast even with the offer of financial assistance from Hughes Tool Co.

Local Conditions

Hughes Tool has said it could build Northeast's railroad service's revenue eight times, until May 15, to finance operating while CAB waits the question of whether it would be so far outside excuse for the rail merger to proceed in the interim. However, the law as it stands on Northeast's pronouncing conditions to postpone three railroad authority.

Cohesive formula agreed to such a postponement last week.

After May 15, if CAB has not settled the rate of CAB rail-subsidy negotiations, Northeast, then the railroad will be as it is now. Basically, this it cannot do without its Florida subsidy.

Proceeding with the renewed case will be a waste for the control route to be affected but provided much needed revenues from about 100 cities. Both National Airlines and CAB's Bureau Counsel had asked the examiner in the renewal case to reconsider his decision.

Both companies said Eastern had failed to establish the conditions of good cause and sufficient waiver required to order taking of operations.

Hughes Tool and that court of the aforementioned Eastern went to war over Hughes' short stay abroad, as far as CAB said the few questions not answered were "legitimate, appropriate or irrelevant." Hughes Tool described the attempt to subpoena Hughes as a "strategy designed to embarras us." Regarding the subpoenas, Sen. Hughes had known reluctance to make public appearance.

Hughes Tool said its subpoenaed flight record could be reasonable to determine whether an operator is created or on a position to control Eastern, such as the Rockefellers, to notify regarding Eastern Air Lines' award in the Northeast case.

Not Directly Involved

Hughes Tool said that Eastern's interests are no more or less than that of any other party. The tool company said CAB is incorrect that Eastern is not directly involved in the litigation between it and Northeast. Eastern, Hughes Tool said, was named party in the proceeding in order to be held as the issues had to be allowed to become an adversary in the case by allowing the airline to cross-examine Hughes.



Convair Delivers First 990 Transport to American

First of American Airlines' 19-plane order for Convair 990 all-passenger powered transports was delivered recently. Aircraft will remain in San Diego for training purposes. Second 990, which will be delivered shortly, will be flown to Tulsa, Okla., and then to New York, where initial delivery ceremonies will be conducted. Both of the 990s are envisioned for passenger service but American will utilize the aircraft in a comprehensive landseas program before introducing the 990s into scheduled operations later this year.

Local Service Airline Profits Set Record

Washington—Local service airline industry's new first and rate rebates formula gave record operating profit in most of the carriers last fall while raising the industry's total expected sales only 10% to \$2.5 billion last fiscal year, Board of Governors Board purchases.

Rising at the 15 local airlines an

increase from a total \$1.9 million operating loss in 1962 to a \$5.6 million operating profit, on the basis of a preliminary study of the current operating results for 11 months of 1963 and an estimate of the final March 31st quarterly which the Board estimated last October would total

Local Service Operating Results—1961

(Operating in thousands of dollars)

Local service airline	Total operating revenue	Federal rebate allowance	Total operating revenue	Total operating expenses	Operating profit
Airline	14,300	8,727	20,120	20,162	292
Braniff	3,810	3,314	9,304	8,159	1,186
Comair	4,346	3,679	8,026	7,899	328
Frontier	8,021	6,356	14,420	14,199	228
Delta Control	5,937	3,937	9,226	9,248	-218
Network	10,426	6,235	18,719	17,407	1,308
Air America	6,546	4,233	23,210	24,004	-793
Delta	7,427	4,917	12,345	12,345	0
Pacific	7,196	5,942	11,128	10,120	1,008
Piedmont	8,201	6,363	13,410	12,898	513
Southern	6,402	6,211	10,441	10,045	393
Twa-Tropic	4,944	4,015	13,491	9,818	373
West Coast	7,811	5,268	13,389	10,985	1,318
Total	114,743	67,723	177,465	167,314	9,151

Source: Bar and Bar based on 11-month figures with 12th month estimated.

which \$5.7 million are reported to amount to \$62.7 million.

At least five of the airlines—Macmillan, North Central, Delta, Southern and West Coast—are expected to take part in the formula's profit-sharing provision under which a percentage of operating profits at different levels is remitted to the Board. Operating losses at those carriers in 1962 totalled \$5,595; Macmillan, \$1,125; North Central, \$1,000; Southern, \$14,496; West Coast had a \$70,000 operating profit for that year, as compared with an operating profit of \$2,134,800 under the rate-of-return rule of 1961.

A final unusual adjustment to these figures is CAB's setting the real net margin could change, thus appear operating profit but if it is doubtful that an change would be significant since the carriers are generally adhering closely to CAB's rules on the formula, a Board spokesman said. One of the main reasons he pointed out is that disbursements, which had a minor effect as the airlines under the previous rate-of-return formula, have been greatly clarified way to avoid any difficulties.

The data must take, designed to include the highly complex and many variable factors previously used, in con-

Local Service Airlines 1960-61 Comparisons

(In thousands of dollars)

	Local service airlines	1960 over 1961
Item or comparison	1960	1961
Total commercial revenue	\$1,234	\$1,762
Passenger traffic	54,644	49,733
Total operating revenue	\$47,393	\$37,681
Total operating expenses	\$44,369	\$47,664
Operating profit	2,682	1,023
Revenue to break even	\$1,193	\$1,130
Source: <i>Boyd and Key</i>		

solved a practical means of controlling and predicting the airline's cash flow needs, while offering their management means to reduce their operating costs.

Safety parameters, essential for providing the carrier an allowable rate of return on investment, as tailored to a sliding scale of flight frequencies, plus other cost savings and the total cost of aircraft usage. Premiums are highest on a schedule of 100 percent plane value per return per day and decline to a level of 600 plane miles with no cash paid beyond that flight frequency.

The plan also includes a profit sharing provision under which the airline would be able to CAR 50% of its profits earned between their established rate of return and a return of 15% on investment, and 75% of the profits in excess of the 15% return. The maximum rate may range from 9 to 12.75%.

While the Board feels that the high savings under the plan does not set a direct reflection of precise management efforts in reducing expenses, as other flight schedules, it has satisfied the industry that since all

airways are needed to the best formats, CAB is now studying several more and has asked the industry to also conduct a study.

In the Board's logic, in case studies with the industry, as well as the rest of the airline industry, have emphasized the firm of Stevens, Analyst and Research Corp. of Washington, D.C. to conduct the study.

In its present form, the Board feels, the formula has failed to reflect the changing conditions of air route mileage and equipment. The result has been that while carriers have adhered to CAB's ground rules on subsidy, the Board has been forced to make a series of individual adjustments to the monthly subsidy contract applications.

One of the major weaknesses of the formula, cited by the carriers in the difficulty of profitably absorbing new route grants granted in route case studies of the various Airline Association of the Americas, consists of maintaining subsidy funds for those routes which appear to be close to sole longitudinal or off-line routes in a low load situation. In addition, they are

Counter Space Issue At Dulles Is Settled

Washington—Federal Aviation Agency has agreed to settle the dispute between local travel agents and the new Dulles International Airport terminal building after recent verbal threats from FAA of possible action.

G. Ward Hobbs, director of the Bureau of National Capital Airports for FAA, and the agreement reached last week in evidence of a "true spirit of cooperation" on the part of the 17 carriers who plan to operate from Dulles after its scheduled opening next October.

FAA Administrator N. E. Hahn warned last month that any airline which threatened to leave Dulles would be subject to immediate disqualification from the right to bid on the new airport (AW Dec. 25 p. 28). The agency generally had refused to grant CAB data on how much counter space they would require at the \$310-million airport.

A follow-on meeting to resolve several fees and general user needs a scheduled for Feb. 1, Carter reported to attend are Alitalia, American, Braniff, Delta, Eastern, National, Northwest, Northeast, Pan American, Pan Am, Trans World, United and Lake Central.

FAA has recently issued a letter from British Airways Agency Corp. indicating it intends to offer Dulles service. It offers foreign carriers extensive interline rights and is forced to expand the services. U.S. airlines share demand needs that have exceeded our capabilities," Hobbs said.

It would be possible to build 600 ft address at each end of the area needed to accommodate new routes, according to Hobbs.

Aeroflot Discloses Passenger Figures

Moscow—Russia's Aeroflot plans to carry about 30 million passengers this year compared with approximately 27 million in 1960, G. Shchukinov, the Soviet airline's manager, told Soviet press chief disclosed. This is one of the few instances when Aeroflot has revealed specific traffic data.

Aeroflot's total, Erivan, Leganes, and the airline will carry 350 million passengers in 1960. Commencing on the outlook for the 1961 year forecast in the Government Price draft program, Leganes and the route system will increase to 500,000 km (310,700 mi.) and mail and freight volume will amount 34 billion kg in that year.

Exclusive controller and other short-haul air service, Aeroflot's passenger total for last year was 12.51% of that of the Russian industry. Shchukinov said that as the air market future, Aeroflot undoubtedly would carry more long-haul passengers than the railways. He said international transport overall is responsible for distance market 160 km (100 mi.) and between 580 and 1000 km that can compete with rail and with transport but not with competitive air 1,800 km.

Shchukinov made it clear that Aeroflot has no problems with other industries, particularly in the area of ground facilities and services.

"One of my conclusions, for example, is the Ministry of Transport Commissar," he said. "We plan to make changes with ours. Because of this, notwithstanding often strict and a sort of sense of uncertainty correspondence is carried on."

No Settlement Reached In Two Labor Disputes

Washington—For Airlines, World Airlines and the Air Line Pilots Assn. remained deadlocked on what would be joint labor-management committee of the three. Trans World Airlines' executive committee, which recommended a five-day eight-hour day for increased operations (AW Oct. 25 p. 29), failed to reach agreement to settle the dispute. The two sides had been unable to agree on the number of hours to be worked.

It is not a matter of revenue in itself, but that money is being expended by the airlines in the form of increased wages and benefits to factors such as the offering of unemployment and health care services in the name of competition and the developing effect upon revenues of the so-called "prosperous" Boyd said. The previous version, too, had Board members voted against a five-day eight-hour day, but in a vote that the carriers might then claim to reduce operating expenses.

CAB Approves No-Show Penalties, Boyd Cites Lack of Cost Control

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As an example, the chairman, and the case of Capital Airlines, which will move its base to Dulles, has been given a higher penalty on passengers only if the industry would agree to pay passenger fares a higher penalty in cases of return flights.

The Board allowed 22 days for negotiations on the plan, which would become effective Nov. 1, 1961. The maximum fare will be a reduction of 55 or 58% of a passenger's fare whichever is greater against passengers making a round trip from Dulles to another city not covered prior to flight time. Minimum penalties should be \$50.

Airline Penalty Provided

However, CAB must consider whether to give a penalty of \$35 or 58% of the one-way fare, whichever it gives to passengers making a round trip in the airline has not yet the space to another passenger.

The CAB noted that airlines have been sufficiently numerous to impose a special fare investigation of the passenger.

The Board has concluded that there were 14,000 subsidized customers in 1960.

Separation of the "no-show" problem was one of the industry's main initial problems referred to by Boyd in a speech before the Economic Club of Detroit.

Beyond the Board's recent approval of a 5% general fare increase (AW Jan. 1 p. 27), Boyd said, was a desire to alleviate the industry's immediate financial problem, although all members of the Board agreed that the root of the trouble lies elsewhere.

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Controlling the industry's no-show program and scheduling practices, Boyd declared, "the plan left of the routes that the carriers have acquired fit more efficiently than it is re-

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In the same vein, Boyd said the CAB is approaching the problem of cost competition on a broad front, ranging from a re-examination of route subsidies now being served by two or more carriers and reviewing an award by the use of centrally located regional airports.

Market Research Subsidy Asked

New York—W. A. Patterson, president of United Air Lines, last week proposed that the Civil Aeronautics Board consider a marketing research program and introduce leases of certain passenger planes to the project.

Challenging that both the industry and the public are split over what can be done, Captain W. A. Patterson called for full field investigation of the nature of the root cause of the industry's problems.

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Larger, Tougher Florida Market Foreseen

New York—Eastern's battle for leadership in the Florida tourist market will see more major competitive developments in the future season.

Survival of Northeast Airlines at least through the winter appears likely but Higher Test has propped up its carrier's financial position. Western Airlines and National had hoped that Northeast would fold financially but the rest of the Florida picture, however, it would seem that Northeast will be competing to the best of its abilities in the winter. Northeast will experience a first half season with about \$800,000 plus which is not far enough down, does not serve as a strength with little in the way of reserves.

• **Costbook of Eastern** is set to receive still stronger after the addition of power in the northeast. Eastern will receive a steady flow of new equipment last summer. With additional deliveries, the airline is growing big strong with an almost tripled air capacity in the year but.

• **Merge of United and Capital** puts the nation's largest airline in Florida's favor in the first test. The combined carrier takes ten Capital's former routes to Florida and is scheduling long nonstop flights.

The airlines expect an improvement in the Florida market this winter following a poor season last year where

Eastern expanded and market share has brought some bad problems which didn't get the season off to a good start but airline via this route has reflected in traffic and there probably is a mix of good and another will make possible a good season.

The market this year will be an

process of two by two or three.

Following Eastern's lead, Northeast and National have announced opening of their nonstop flights to the Florida market. Eastern in 1960 inaugurated the type of service designed to be

competitive with surface bus transportation between Pittsburgh and Miami with Super Constellation equipment and has since extended it to Florida cities Cleveland, St. Louis, Detroit, Boston and Philadelphia. In this service the passenger's ticket is his reservation and is not refundable less than 24 hr before departure. Eastern calls this service Arctic. National calls it Sun Bus and Northeast calls it Southern Sun. National using 37-passenger DC-8s will operate from Philadelphia nonstop to Miami, from Boston to Miami, to Washington and West Palm Beach and from Las Vegas to Miami. However, Northeast's bus operation will be confined to a single round trip each week between Boston and Miami on Transocean using 6-passenger DC-6s.

There is a continuing series of airline's moves to Florida that came from the Northeast and Midwest:

• Delta will expand 18 daily jet flights from Detroit to Florida with a total of 1,152 seats. Its subsidiary Delta will operate seven DC-7s and DC-8s flights with 451 seats each while Delta Air Lines' sister of Cincinnati and Chicago Equipment DC-8s and 50% Delta by the end of February, when the airline's jet fleet counted of 11 DC-8s, totals 15 DC-8s and 15 720s between New York and Miami. Eastern and Pan American operated four jet routes this October, total of 20. Transocean, jet flights to Florida will go from St. Louis, New York, Newark, Newark, Newark, New Jersey, Boston, Pittsburgh, Cleveland and Baltimore. In addition to the 16 other jet expansions in the market, Eastern will continue to operate piston equipped to field capacity will be considerably increased. It will also pick up the center. Eastern will be in a better position as its first fall of seat than it would have had last year when usage was slower. Eastern's share of Miami passengers for the first six months of 1961 was 45%, down from about 50% in 1958. But Eastern expects to come back in time to the 1958 level this winter. This ranking of Miami's organization of carriers, indicates firmly to all jointly and not just to the Northeast and Midwest. North

east Airlines claims it carried about 35% of passengers traveling to Florida from the Northeast last fall and will increase its share in 1962.

• Northeast's jet operation in the market will be confined to the New York-Miami route with a fleet of 18 DC-8s most trips made at low cost. Jet seats will be down 40%. However, due to a change in cost accounting, fuel savings, including Delta and partner seats will be up in all Northeast's aircrafts destined to Florida up 6% to Nov. 1, 1961, up 40% to Nov. 1, 1962, to Dec. 21, Philadelphia and up 10% to Washington. These present age rate to peak season round trip costs from the point is all Florida points. Considering as prospects for the year National and there network will be more than enough seats available from the North to Florida this winter. The airline will maintain to sell Northeast and "there the youthful and an economic equation" at Northeast as the market Northeast and Eastern could easily handle the traffic Northeast carries in the market National said.

• Northeast will offer more than 2,100 daily jet seats in its Central States that winter a 30% increase over the jet capacity it started the previous season with. Last year it was planning in its 1960, and this winter hopes the same number of seats. Northeast's first market, in addition, the airline's DC-8s will serve Florida. Northeast predicts record-breaking traffic this winter reporting excellent indications from hotel and travel agents in Florida and a long history of advance bookings on Northeast flights. Northeast is strong advertising package over to Florida. Regarding its financial status, to complete this winter, achieves says Northeast has a sensible advertising campaign a sign that cost is sensible.

• Northeast was not of the Florida jet bus market for its planned purchase because of strains which held up as expansion. No service to Florida until last January. Florida is the winter Northeast will be operating four jet flights a day from Chicago to Florida, plus two Eastern schedules. One of these flights is a jet which will operate nonstop Chicago-Miami flights and the other flies twice a week. It will stop at St. Petersburg the other four days.

• Trans World Airlines will operate a daily 707-120 nonstop between St. Louis and Miami plus a Super G Constellation with stops between the points. This is in addition to TWA's present jet service. The airline made a good thing out of this route a couple of years ago offering single plane service from Miami to Los Angeles via St. Louis. Civil Aeronautics Board, however, ended this by requiring a change of planes as well as flight numbers at St. Louis.

MATS Reports Low 1961 Accident Rate

Washington—Military Air Transport Service said its 1961 flight safety record was the best in nine years due to Congo shift operation and a lower altitude of polar flights.

MATS said its 1961 accident rate was 1.05 per 100,000 hr. of flying time. The 1960 rate was 2.45.

The 1961 figure included the operations of the Air Service Service, which uses transports and helicopters in addition to conventional aircraft. The work of MATS in photographic and Charter Service and the Air Weather Service was also excluded.

MATS operates 32 types of aircraft totaling 1,200 pieces of flight equipment, including 121 Boeing 707 Intercontinentals, four Convair 880s in flying safety was made. In the long-range transports, MATS shifted aircrafts to shorter distances to coincide with changes in 1960. The result of all types were involved in major accidents in 1961 compared with 16 in 1960.

The last fatalities since October 1958 were reported last year when a C-47 Globemaster crashed near Tucson, Wash., killing 12 passengers and five crew members and a C-47 disappeared with 13 passengers and 10 crew members on a flight over the North Atlantic.

Douglas announced the construction of a demonstration model last April (AVW Apr. 17, p. 42) before any orders received.

This first model is expected to fly in September of this year.

The DC-8's ordered by Trans-Caribbean will be delivered with static cabin variable intensities for use in either all-cargo or all-passenger transports in future.

Capacity will be the DC-8 at 1,300, 10 DC-8s with Park & Wilson's JT3D-3 turbosuperchargers. It has static cabin intensities for a fixed Douglas was often referred to as a retrofit basis for the earlier DC-8s.

Maximum payload capacity of the DC-8 will be 311,000 lb. Maximum payload will be 30,000 lb. and maximum range will be 7,000 mi. per.

Total of 15 orders received by Douglas for DC-8s now stands at 175. Of these 155 have been delivered.

British Pilot-Time Plan Based on 'Points'

London—Air Ministry announced today the introduction of a new system for airline pilots based on an aircrew rating factor to replace as needed the monthly flight-hour limitations.

A confidential report is being studied by British European Airways, National Jet Council for Civil Aviation, and the British Air Line Pilots' Association.

The study started six months ago when pilot-hours and salary experts and flight dealers of BEA and British European Airways, Vickers Vanguards and Vickers Viscounts. The report contains three as different new scales factors for different types of aircraft.

The pilot system also would provide more difficult routes who flying mostly free flights.



Glass-Domed Trams Operate at Los Angeles Airport

Three two-car glass-domed trams capable of carrying 80 passengers apiece recently went into service at Los Angeles International Airport's new terminal. Tram route, round trips between terminal's various arrival facilities at 30-minute intervals. Passes 21 gates plus passenger terminal. A quick turn-around capability is located on loading side of each tram unit, with service to opposite side of tram and of each. Trams, designed and built by the Farnolls Tram Equipment Co. Los Angeles are operated by Anglos Transit, the joint venture of British Telecom Building in background.

BRIEFING

TEXACO REPORTS ON LOCAL AIRLINE SERVICES FOR BUSINESS AND PLEASURE

Integrated local and trunk airline service speeds flights to intermediate and smaller cities



One reservation...one ticket...one set of luggage tags now takes the businessman "all the way by air" either to or from any of 470 cities served by local carriers. He can fly all the way; board a local, then switch to a trunk at a terminal city; or fly a trunk cross-country, then take a local. Because of completely integrated service, he'll arrive at his destination with a minimum of delays and changeovers.

Quark Airlines, in fact, is so oriented to this kind of service that convenient trunkline connections are the dominant factor in its scheduling. Nearly 2,000 passengers use Quark's services each day and approximately two-thirds are connecting with other airlines.

"Flying Fish" expand operations for Alaskan carrier

Proof that low-cost local airline air freight is paying a bonanza to perishable food processors in the resort market: by Northern Consolidated Airlines of 200,000 pounds of freshly caught King salmon from Bethel to Anchorage—a distance of over 500 miles.

Settling able to process catches taken hundreds of miles away means a bigger—more profitable operation for this carrier.



AIRBORNE KING SALMON —證明 the joint venture, daily shipments of King Salmon made possible by the merger of two small Alaska operators, is beginning to develop. Alaska Fresh Fish Co., which has been supplying salmon to Alaska Fish Processors, Inc., has joined King Pacific Airlines here as the newest Alaska processor to be used.

For only \$90 — 15 days' unlimited vacation air travel in America's fabulous southwest

The biggest vacation travel bargain in airline history—as well as the most tangible asset yet to the government's "Travel U.S.A." program—is now available. Braniff Airlines and the American Association of Travel Agents have jointly launched a plan to offer vacationers unlimited air travel within the Southwest area for a flat fee of \$90, costing \$30 or \$360—and good for 15 or 30 days. Included in the deal are unlimited flights to some of the world's greatest tourist attractions—such as Disneyland, Las Vegas, Reno, Grand Canyon, Palm Springs and Hollywood.

Braniff's travel bargain is but one of the many marvelous vacation opportunities offered by local carriers. Texas Airways, for instance, offers a variety of fiesta tours—taking in such famous resorts as New Orleans, Natchez, Miss., Hot Springs, Ark., and the beauty and romance of Mexico along the historic Rio Grande.



GLORIOUS RENO — One of the highlights on the fabulously fun "Travel U.S.A." plan. Local carriers offer almost limitless vacation opportunities for the non-stop budget-vacationer.



TEXACO REPORTS ON LOCAL AIRLINE SERVICES FOR BUSINESS AND PLEASURE

Information on how local airlines contribute to America's business growth... prepared by Texaco Inc., Aviation Sales Dept., 135 E. 42nd St., New York 17, N.Y.

SHORTLINES

• All American Engineering Co. of Wilmington has a \$45,000 FAA contract to design and construct seven toll-free toll booths at Glasgow, Del. The facilities will be used in development of a new toll system. The project may be the first to feature higher than ever toll rates. This started early for construction of a tollgate powerful enough to duplicate the leading load of a jet Interceptor to test existing gate.

• Civil Aeronautics Board has issued the 1961 edition of its Handbook of Airline Statistics. It contains airline safety, financial and other information for the year 1959-60. The price is \$1.75. It is Superintendent of Documents, Government Printing Office, Washington, D. C.

• Federal Aviation Agency will review regulations limiting the height of cargo containers designed for use in aircraft compartments on Jan. 30. Effective date is Feb. 2 until FAA has collected needed time to amend the governing regulation.

• Hawaiian Airlines reports it carried 117,000 passengers last Dec. 22. The airline completed 32 years of open skies last November.

• Joseph Adams, controller director of the Air of Local Transport Service, is among 16 members appointed to the Trade Advisor Committee of the Committee Department U. S. Travel Service. The committee is to advise the Travel Service in promoting the "Travel U.S.A." program. Committee Secretary is Peter H. Hodges, president Central American and the Caribbean panelist of the Independent Agents Association. Dr. Ben Clark, president of Trans Caribbean Airlines, is committee member.

• KLM Royal Dutch Airlines will begin service between New York and Casablanca-Dakar, West Indies on Jan. 31. At the same time KLM will direct passenger service between New York and the nearby island of Antigua will be discontinued. A four-hour connecting flight will take Antigua from Casablanca. KLM gets off with round-trip flights three times weekly instead of the present five daily round-trip schedule.

• Pan Am Airlines reports U. S. fares in international flights have for the past year seen a \$11 per 100 million revenue air passenger mile. Pan Am says U. S. cargo traffic will not have a percentage falloff in the first fiscal year.

AIRLINE OBSERVER

► Watch for fast congressional action to push through new legislation requiring compulsory insurance of airline lines of credit when used in a strike against any major carrier. AFL-CIO is spearheading movement on Senate Bill S.1727, introduced last fall by Sen. John McClellan (D-Ark.). The measure would prevent an administrator's union from making claims against an airline.

► Federal Aviation Agency Administrator N. E. Halsky has filed several dissident reports he will challenge Sen. Thomas H. Kuchel (R-Calif.) in the forthcoming California primary. California political circles have been told that Halsky gave Kuchel general assurance he would not enter the senatorial contest, but Halsky also downed that this is not so. Dedication of candidacy may be filed before March 5 and April 3 for the June 5 election.

► Tourism minus organized air racing is making a strong bid to organize Flying Tiger Airline flight engineers. The group hopes to gain sufficient support to replace the present Flight Engineers International as a representative organization. Engineers are reported to have been conducting a house-to-house campaign among the engineers.

► Watch for Major Air Transport Service, Inc., to award sizable shipper contracts to several major and new holding options on Fiscal 1962 and 1964 MATS contracts. These contracts, published as definite contracts by major carriers, were contingent on the carriers' accepting airways transports. Because major carriers failed to do this in Fiscal 1962, MATS has itself will resort to open bidding procedures to award out relatively large sums of Fiscal 1963 money.

► Search for a successor to Air Line Pilots Assn. President Clarence N. Strain who announces he will resign not later than June 1 (AVW Dec. 15, p. 36), is continuing on the basis of seniority. Large majority of pilots still favor election of an ALPA member. Only one captain signed the recent letter requesting Federal Aviation Agency Administrator N. E. Halsky to seek the position that was rejected by Halsky.

► United Arab Airlines' plan to move New York may be delayed indefinitely because of bilateral agreement complications brought about by breakup of the United Arab Republic. Talks between the USA and the United States are currently stalled, pending word from the British government, which previously approved a London-New York route but now may want to renegotiate the bilateral in light of the USA split.

► United Air Lines will complete a modification program on the long-haul version of its Douglas DC-8 turboprop fleet by the end of the month. The work, being done by Douglas, includes the presence of a secondary "hook up" for hydraulic functions controlling aircraft direction, inflation of lifeboats, pressure fluctuations and operation of rescue thrust application when these "booster" are not correctly positioned.

► British Airways Corp. has announced the sale of three more Viscount 810 series turboprop aircraft to All Nippon Airways, the national Japanese carrier. Delivery of the aircraft in 1962 will give the airline a total of nine Viscounts. Three Viscounts are currently being operated by All Nippon and an additional three are ready for delivery in the near future. The rate being paid to Viscounts is \$155 per seat.

► Japan Air Lines will add three new jet flights a week between Tokyo and the U. S. by April using Douglas DC-8 and Convair 880 aircraft. Two of the flights will be to San Francisco, the third to Los Angeles-Haneda-Tokyo and a new flight will be added between Honolulu and Tokyo.

► Pan Am, French airline counterpart, is designing a 25,000-lb. four-engine STOL transport, powered by Turbomeca propellers. The project is one of many competing for a French Air Force light STOL transport contract.

BRITISH ARMY CHOOSES VIGILANT

After evaluation of all other competing weapons the British Army has chosen Vigilant for its standard infantry anti-tank guided missile. Vigilant is the most lethal, most accurate, and most economic weapon of its class in the world.



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Airline Traffic—November, 1961

	Revenue Passenger Passenger Revenue (Units) (2004)	Passenger Load Factor %	U.S. Air Ton-Miles	Expense Ton-Miles	Freight Ton-Miles	Total Revenue Expenditures	Gross Air Revenue Load Factor
DOMESTIC TRUNK							
American	873,459	49.0	57.1	2,455,556	1,343,751	12,336,256	\$1,573,323
Southwest	195,392	95.788	35.8	1,174,293	1,174,173	10,271,420	45.5
Continental	229,661	87,284	48.8	2,393,504	1,288,685	10,428,819	38.0
Delta	291,691	161,581	48.7	2,383,223	1,249,240	26,487,200	40.0
United	229,661	144,374	47.3	1,261,261	1,000,261	10,261,261	37.3
National	144,270	152,345	38.9	437,380	188,249	1,312,838	16,713,271
Allegiant*	120,840	31,221	44.9	—	—	—	—
Nimbleair*	144,249	97,920	46.1	1,363,774	893,530	1,344,510	16,756,489
Titan World	132,348	334,291	41.9	1,026,129	750,129	1,026,129	14,000,000
Delta Connection	120,274	94,813	44.7	917,971	1,317,121	9,851,331	14,938,331
Western	142,459	79,312	45.6	1,291,243	1,097,278	16,612	4,767,081
INTERNATIONAL							
American	3,312	7,492	48.6	2,176	776	2,212,310	\$0,021,754
Southwest	7,434	39,565	46.3	54,397	218,512	1,289,857	41.6
Continental	37,062	3,285	68.9	3,004	—	14,811	399,631
Delta	14,492	1,000	47.3	1,000	1,000	1,000	21.3
United	30,150	47,285	55.4	1,341,921	4,110	305,381	4,110,381
Nimbleair	14,073	35,158	46.1	1,312,046	4,002	1,302,802	4,110,393
For American	—	—	—	—	—	—	—
AirAsia	3,028	2,981	29.6	42,825	3,439	20,618,538	244,098
AirTran	314,747	1,000	47.3	7,017,120	6,787,347	1,277,210	26.8
Delta Connection	323,467	133,208	55.6	3,342,462	15,188,000	2,327,812	329,956
Pacific	37,874	133,560	68.5	3,787,141	15,523	3,859,879	245,346,309
Panama	17,184	28,120	48.3	181,263	181,263	181,263	31,416,391
South Pacific	112	1,000	47.3	1,000	1,000	1,000	21.3
United World	18,776	56,261	44.9	1,951,438	—	2,006,320	18,444,320
United	15,726	27,582	45.7	558,655	8,266	212,549	1,433,807
Western	3,737	8,712	48.4	9,487	—	38,781	947,648
LOCAL SERVICE							
Allegheny	72,714	71,262	44.6	29,035	49,089	67,579	1,265,123
Bangkok	26,327	7,198	30.3	6,271	14,584	14,584	51.6
Central	24,130	4,938	32.4	1,197,838	28,410	322,437	36.0
Frontier	2,377	1,000	47.3	21,100	21,100	21,100	21.3
Lake Cities*	3,297	5,848	58.9	31,176	24,490	21,282	65,384
Midwest	64,373	14,879	45.0	29,820	34,589	31,811	1,273,324
North Central	74,450	73,485	40.3	42,986	53,941	51,071	1,468,020
Oasis	48,498	9,935	45.8	21,043	32,179	48,272	559,485
Palm Beach	2,617	1,000	47.3	22,494	22,494	22,494	21.3
Piedmont	63,352	9,136	48.4	14,288	20,078	30,924	566,520
Southwest	35,058	14,684	35.4	24,400	18,166	38,812	4,071,001
Tropic Airlines	26,959	6,828	35.6	20,501	11,247	45,819	317,427
West Coast	30,145	7,325	41.7	14,344	4,049	18,704	737,464
HAWAIIAN LINES							
AirAsia	22,444	3,207	35.9	2,713	—	4,115	379,054
Hawaiian	30,320	4,545	52.4	4,429	—	543,874	551,551
CARGO LINES							
Delta Air Lines International	185	422	57.4	56,181	29,784	261,267	261,267
Flying Tiger	—	—	—	—	—	18,081,437	75.2
HELICOPTER LINES							
Choppy Helicopters	13,084	295	47.4	1,817	—	29,991	34.8
Los Angeles Airways	2,331	86	45.2	4,508	2,465	—	61.1
New York Airways	12,385	285	54.7	1,648	1,000	473	91.7
ALASKA LINES							
Alaska Airlines	2,001	4,129	35.8	63,406	1,380	319,318	1,001,912
Alaska Central	3,279	525	47.3	4,298	4,298	1,725	47,913
Central	1,061	288	40.6	2,000	—	1,725	47,913
Flite	3,323	188	47.7	1,864	—	1,864	33,112
Kodiak	128	35	38.7	487	—	725	4,645
Northwest Consolidated	1,348	1,000	47.3	395	395	395	34.8
Pacific Northwest	7,491	8,203	33.8	167,765	9,418	358,324	1,235,515
Reindeer Airlines	1,024	342	34.2	8,746	—	88,342	23,547
Western Airlines	120	47	47.0	727	—	248	4,342
Western Express	3,720	1,000	47.3	31,710	12,431	208,121	33,000
Yukon	2,223	134	50.0	520	—	2187	17,251

* Merriman's Agency was also

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Scott put the **LIFEGUARD** on the B-52

Scott Portable Oxygen Assembly stands by the aircraft commander, pilots and crew of the nuclear-armed B-52 "Superfortress" at all times. These compact, light-weight units provide dependable, quickly breathing protection for individual crews, giving them complete mobility within the aircraft. They also meet emergency conditions in the event of cabin pressure loss or failure of the aircraft oxygen supply.

The B-58 Portable Oxygen Assembly are typical of Scott's capability in the research and development of sensible environmental control and life support systems to meet changing requirements in aviation and aerospace fields.

By using a unique concept of integrated components, Scott has achieved optimum performance in meeting the ever-changing space envelope requirements for environmental control systems in many of today's advanced weapon systems. This concept in Justice resulted in reduced lead time, lower costs, and a much higher degree of sustainment durability.

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AERONAUTICAL ENGINEERING



ASP 412 layout for tail-sitting aircraft is based on Army requirements and missilecarrying mission. Gross weight = 11,200 lb.

GE Projecting Lift-Fan Aircraft Designs

By David A. Anderton

Bendix, Ohio—Design programs of jetlifts built around General Electric's lift fan propulsion system moved closer to reality with the company's recent contract award to Boeing Aerospace Co. for construction of a full scale flight research aircraft.

Boeing is GE's flight Propulsion

Laboratory, Detroit, Mich., who have worked on the development of the lift fan system, have planned that work with a series of aircraft layouts using liftfans. Their studies have ranged over the spectrum from short take-off and port of ground assault to medium range commercial transports. To date, the designs have started at 5,000 lb gross weight and gone upward from there.

Such designs, studies are not unique with GE. In the past, such entries into the field of jet propulsion spent much money at first and more, on the orb of assault in use than unconventional new engines. More recently, the developers of lifting propulsions systems for VTOL aircraft have performed design work to meet proposed mission requirements for at least two reasons. This used to be able to take up some of the cost that can be better distributed with the aircraft, and they used to anticipate as many of the development problems as possible well in advance of overall certification.

Typical Studies

The types of military aircraft proposed show typical studies made in the design to justify military acquisition or typical missions. None of these is offered as the final form for any mission, there are too many steps between proposal and construction which can affect the armament, structural and propulsion characteristics that GE follows. These include acceptable designs that could be built and would be close to specific mission. In all cases, layouts have been made in enough detail to do the small proposal calculations of weight and bid, performance, and stability, and control.

GE's liftfan propulsion system uses a gas generator to drive a large-diameter lifting fan for vertical thrust during the takeoff and landing modes. A smaller valve directs the gas generator exhaust

through a conventional nozzle for the forward flight regime.

Major advantage claimed by GE for the system is the lifttofthrust ratio. The fan gives a vertical lift which is about three times the thrust of the basic engine in horizontal flight.

Dragonfly, funded as a study contract by the U.S. Army during 1957 and 1958, the liftfan system has been tested in a fullscale prototype. The company's jet lift studies are in the 45- x 90-ft fullscale tunnel at the National Aero- nautics and Space Administration's Ames Research Center. Test series of tests were also funded by Army as part of a 1970 contract to establish the feasibility of the liftfan system.

Research Aircraft

Most recently, GE provided an initial \$6 million to Bell for the design and construction of a research aircraft to be powered by a pair of 6-ft dia lift fans located in the wings. Although this is to be a test aircraft, aimed at validating the liftfan system under fullscale flight conditions, the Bell-GE design could well be the starting point for growth into an assault to meet the Army's intended surveillance mission.

Two of the GE research layouts are

based on the performance of the Army's current or serviceable and reconnaissance aircraft. Such a mission requires peaking of cruise defense at low altitude, and high subsonic speeds for acceptable survivability. Interchangeable, self-contained pods could carry specific equipment—radar, photographic or infrared surveillance gear, for example—or specific missions within the framework.

Alternate judgments of target acquisition and electronic equipment interchangeability and compatibility and survivability would be required to validate the configuration capability. Finally, the airplane could be armed to attack targets of opportunity.

First design study—ASP 610—an engine-powered test bed in the fuselage, using test data from the Army fullscale fanbed. The aircraft would weigh approximately 30,000 lb. Overall length is 41 ft, wingspan is 31 ft, and height is 13 ft. Pitch control is derived from a fin installed in an extension of the tail structure, and roll control is handled by wingtip reaction controls.

Second design study—ASP 613—a further approach to the same mission and is about one-quarter lighter than

the first proposal. Weighing 18,200 lb overall gross, the design has two wing fans, with a probe fin on the nose for longitudinal control.

This design is estimated to have a testbed top speed of Mach .95, and a VTOL mission radius of action of 218 mi, under hot day conditions.

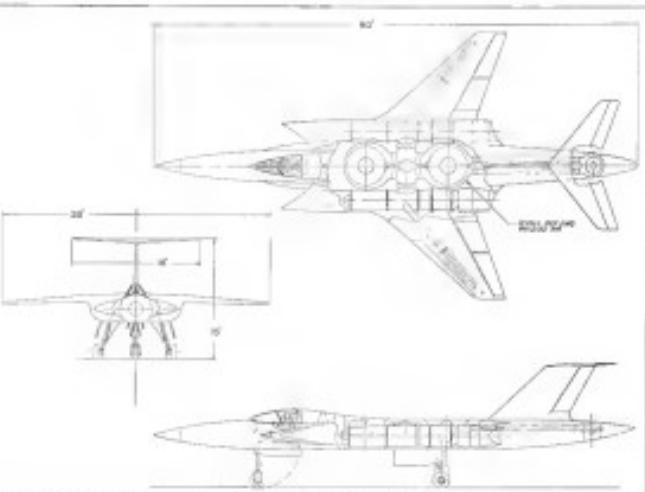
A full test of 450 hr under the starboard wing could be followed by a Mach .95 GAM-73A Belljet air-to-air missile strike under the starboard wing. In addition, the drawing shows the outline of a side-looking radar installation under the leading edge fairing.

Search and Retrieval

Contract Air Force requirement for a search and retrieval aircraft, outlined in SOR 187, has been studied as a "mother-daughter" concept by entities for teams participating in the competition. The larger mission cells for operation over a 1,000 nautical mi radius, using an aircraft of the Lockheed C-130 type as the mother plane. Mother and daughter take off separately, both up in the air, and end at 240 ft at permissable altitude east in the 1,000 nautical miles. At that point the combination lotion for four hours, 18,000 ft. Then the daughter plane descends



ASP 410 is proposed to meet requirements for search and retrieval aircraft.



FIGHTER-BOMBER PROPOSAL: fronte freefall lift fan installation, was developed around NARD requirements.

ITSELF! ITSELF!

By J. J. LIPINSKI

Itself, King of the Phlebe Empire, had never imagined how the net possibilities of his empire could bring him power, wealth, and limited animal susceptibility.

The After Egg said, "Well, how is it with that I have?"

The After Egg was a booster, a greater a shoulders in action and in his limited way, a copywriter.

Itself did not answer. During the sleep period, he had drifted over a universe, the walls of which drooped gently under the weight of his deceptively inert girth along the circumference.

Now a cross of observations. No light ever penetrated miles above into the eternal night here at the deepest bottom of the ocean. Itself perceived the black world which surrounded him with high frequency sounds which he translated continuously in all directions. Like a pack of ears, they analyzed the structure of the things in his watery universe by interpreting the returning echoes. And the interpreting animal of suspicion was a clever who exploded itself to avoid changing pressures, tem-



peratures and current flows. Unknown to him, what he observed, because part of the immense solid of data by which computes for every encounter the inter-relationship of consta and temperature, and that predicted what and where everywhere with certainty down.

He was almost perfect perception. Clearly and unmistakably Itself made out the intruder in the far distance of that twinkling mirror. A ship? Anchored in rock at the very edge of the galaxy?

The After Egg pointed. "You're not going to let somebody invade your territory, are you?"

Immediately, Itself was furious. He saw water as the source of the other-shaking belief of his almost solid mass body in a flesh, a nuclear reactor heated the plates at the expansion chamber. The sea water which flowed through the chamber burst into howling clouds of steam, and he jolted forward like a missile.

Around at the ship, Itself selected the arm of four anchor lines with the accuracy of a surgeon holding a scalpel. When he first arrested, he tensioned the second cable, and bent through it. Then he heeded for the third cable.

The starship had driven itself completely berserk. He raised his nuclear pellet gun, and fired twice. The test split seconds later, a veritable shower of sparks. A blast from the nuclear journal line burst.

The After Egg yelled. "You're not going to let them get away with that, are you?"

But the king of the Phlebe Deep was not held, and could not be prouled.

In due time there came a report to

the nearest headquarters.

Computer Center shows no normal data from of the star-ship anomalous wave-turbulence system. You may recall that these electronic meccano were programmed or suspicious, anger, and the size that they owned part of the ocean. After the we could never get their enemies to surface, they were too suspicious of us."

The king of war, like the seven sons of Eve for shovels, fished and reeled and moved, a constant dynamic, always looking for a better angle, a better position, a better, however, than one's strongest, or easiest. Yet in meekness, the quiddities of water meekness truly and only killed each other out.

Through the Phlebe Deep There began presently to flow an enormous billowing river. It carried the sound visual in a long, strong upward direction. But it was not a noisy, turbulent, the drifting, the swirling, breaking surface, and neither dry or on before it was over.

A small pocket bounded it. Farther along there more than a month later constants and solar maintaining the date age—carefully analyzed what had happened. And so—

A new king, made in the first "day" of his reign and named the After Egg rex. Well, itself, what's the program? itself glided with a royal impulsion.

Would now like your own jacket model of "Itself"? See column at right.

The alien had so far used no energy that might be detected from the surface. But what had come to earth to establish a base for invasion. Their interaction were to accumulate enough data about under water systems, to enable them to leave Earth, and eventually to be able to enter another large star system. They can't cause any noise. We the people, are very highly armed, and they relied on us in these black waters without a fight.

"What can we do with that alien?" "Wait it?" someone urged.
"That's dangerous!" the confederate heraldized.

"We can't be in greater danger than we already are."

"I think," said the captain, "that friend I don't know why he seems at all, and I don't believe he has any real cause." He continued when a voice broke his reverie.

"Set up a response system. If he does strike with another one, it will automatically fire back. We'll make that model of a choice."

The second seabird had driven itself completely berserk. He raised his nuclear pellet gun, and fired twice. The test split seconds later, a veritable shower of sparks. A blast from the nuclear journal line burst.

The After Egg yelled. "You're not going to let them get away with that, are you?"

But the king of the Phlebe Deep was not held, and could not be prouled.

In due time there came a report to

the nearest headquarters.

Computer Center shows no normal data from of the star-ship anomalous wave-turbulence system. You may recall that these electronic meccano were programmed or suspicious, anger, and the size that they owned part of the ocean. After the we could never get their enemies to surface, they were too suspicious of us."

The king of war, like the seven sons of Eve for shovels, fished and reeled and moved, a constant dynamic, always looking for a better angle, a better position, a better, however, than one's strongest, or easiest. Yet in meekness, the quiddities of water meekness truly and only killed each other out.

Through the Phlebe Deep There began presently to flow an enormous billowing river. It carried the sound visual in a long, strong upward direction. But it was not a noisy, turbulent, the drifting, the swirling, breaking surface, and neither dry or on before it was over.

A small pocket bounded it. Farther along there more than a month later constants and solar maintaining the date age—carefully analyzed what had happened. And so—

A new king, made in the first "day" of his reign and named the After Egg rex. Well, itself, what's the program? itself glided with a royal impulsion.

Would now like your own jacket model of "Itself"? See column at right.

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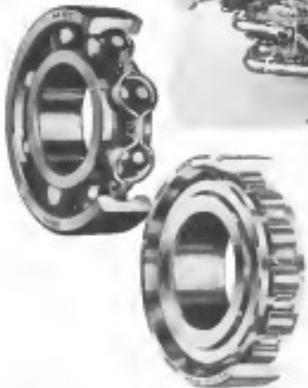
Please feel free to look here in anywhere.

Hoffman / ELECTRONICS CORPORATION
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RELIABILITY
COUNTS IN THE HEART OF THE X-15



North America's X-15
powered by Thiokol's LR93 rocket engine
shown below an display stand



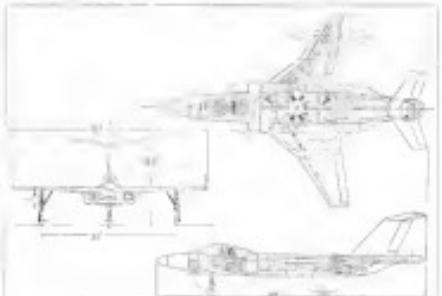
MRC STAINLESS STEEL BEARING used in the main pump of X-15's liquid fueled rocket engine has contributed to the phenomenal success of this famous aircraft which has far exceeded test expectations.

Leadership

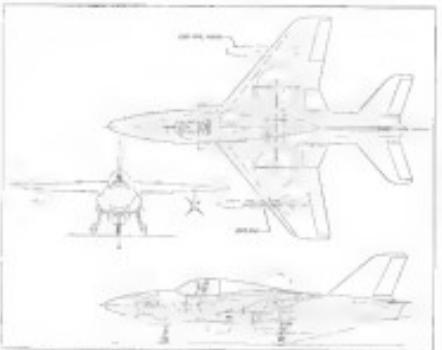
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ASP 410 was first design study to satisfy Army's concept of reconnaissance and surveillance



ASP 600 is smaller and lighter version meeting same requirements as ASP 410.

and lets down to sea level where it can dash a 30-mile stretch or longer at a maximum speed of 110 M.p.h. followed by 70 miles of hovering during which time no fuel storage is required. The daughter aircraft can be a seaplane and landlop with the mother C-130 and the combination carries load of 240 M.t. and penetration altitude.

Gulf's design - ASP 410 - based on the current knowledge of the X-15's 5-M.p.h. fuel system using two of them in a series circulation. Gas generation uses a pair of non-turbulent J3 engines.

The aircraft weighs 13,000 lb. gross, and can achieve a payload of up to 3,000 lb. Gross is 14.7% by weight to surface travels or other mission. Endurance is about one hour.

Wingspan is 20 ft., length is 30 ft.,



**PUMP
PRIMERS**
ARTHUR A. NICHOLS

HOW ONE PUMP CAN SERVE SYSTEMS

■ Marine designers have been recently employing pump primers. These pumps which prime the incorporation of an air valve pumping element in a separate chamber of the impeller-type pump so that the air valve opens to a control position at start up.

■ The Gardner is a type of internal gear pump consisting of only two working parts: an inner toothed element and an outer, relatively toothed element. The outer ring is driven by a motor while the inner "teeth" provides a chamber to move liquid from the inlet port to the outlet port. Pump capacity is measured by the volume of liquid which is multiplied by the number of driver teeth and RPM.



■ The unique construction of the Gardner type pump permits several pumping functions in a single pump housed mounted on a single pad and driven by a single shaft. Generated air pressure can be used to prime the low pressure hydraulic drive system and reduce oil pressures at about 1000 psi may be controlled by this means.



■ The designer has several variables to ensure a given capacity within his space limitations. Gardner designs also gives the designer the ability to incorporate a pump with a reservoir chamber volume and forced air drive. Thus, it is possible to increase the discharge pressure and speed to ensure the needed capacity.

■ The Gardner pump is a positive displacement type, delivering a precise amount of fluid in direct proportion to revolution. In this respect, it is similar to a gear pump. It is high-weight, vibration-prone, produces exceptional performance at high speeds and has a tendency to run noisy. However, in addition, it is compact and extremely quiet in operation.

■ Testbed data is available and your inquiry is invited. W.H.N.C.

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THE MARKETPLACE



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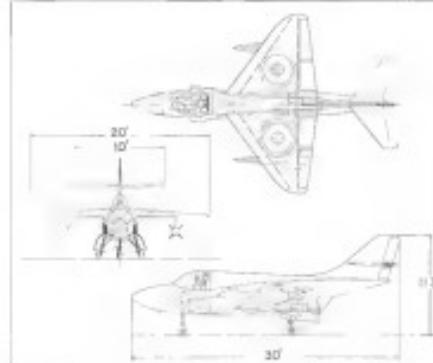
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ASP-D12 is designed to meet NATO fighter-bomber requirements for VTOL aircraft.



SMALLEST DESIGN single 6,000 lb. was placed in Army close-support aircraft

and height of the aircraft is 31 ft. 6 in. GPN's designers have detailed two main proposals both around a six-seat fighter-bomber. Both of these are supersonic VTOL aircraft, and both of them are in the class of design which meet the NATO specifications current in April 1961 for fighter-bomber. Since that time, NATO thinking has changed somewhat so that in detail these proposals can not exactly match current requirements. But they do serve the useful purpose of indicating the sort of performance potential of aircraft designed to the specifications.

First of these designs has a square fuselage section in shape and side view

the Republic F-105 series, but weighs in at a considerably lighter 27,000 lb gross weight. There are two 500-lb class lift fans in the fuselage, driven by an opposed jet generator which could be supplied GE J79 turbines. For pitch control, a small fin is mounted in an extension of the tail structure. Roll control would be handled by surface controls at the wing tips, but be activated from the jet generators. Length of proposed design is 60 ft 3 in., span, 33 ft 11 in., height to top of tail in diameter position, 18 ft 3 in.

Second of these proposals is ASP-D13, a two-engine configuration with a low aspect ratio delta wing. The two

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	Type L-3420	Type L-3430	Type L-3710
Maximum Peak Power	1000 watts	500 watts	250 watts
Frequency	8.000 ± 30 Mc	8.000 ± 30 Mc	18.000 ± 100 Mc
Planned Voltage	6.3 volts	6.3 volts	6.3 volts
Planned Current	.5 amps	.5 amps	.5 amps
Anode Voltage	1400 volts	1300 volts	1300 volts
Pulse Amplitude Margin	2.5 amps	1.5 amps	1.5 amps
Modulation Duty	.005	.01	.01
Pulse Length	10 N-30 μsec	62 to 3 μsec	62 to 3 μsec
Size	1 1/4" cube	1 1/4" cube	2" cube
Weight	6 ounces	6 ounces	14 ounces

powerplants—again planned to be the J99 or an equivalent gas generator—drive four lift fan jacks on the wing root. A pitch fork is located in a well-formed position in the fuselage and thus air supply remains self-sufficient. Total weight of the aircraft is 20,400 lb. and the ratio of payload to gross weight is approximately 1.09. This corresponds to a total lift for the VTHL model of 30,500 lb.

Balanced Wing

The 37-ft. span wing is balanced at the root to take the 50 lbs. installation. This guarantees that, in flight, it moves effectively in aerodynamically less 4% about because of the airflow into the lifting system. Wing aspect ratio is 1.9. The efficient wing load is 170 sq. ft. to its total wing loading, a record gain weight in 19.5 psf.

Over a length of the design is 60 ft. and height to the top of the tail is 17 ft.

Performance is calculated as follows: with maximum speed of Mach 2.1 at 34,000 ft. altitude, initial rate of climb is measured at 42,000 fpm. Payload on a repeat mission is 1,900 lb.

Natural fuel load is 9,665 lb., but external fuel can be carried up to a maximum of 20,000 lb.

PRODUCTION BRIEFING

Western Electric Co., Inc., has received a \$1.8 million Army contract for additional production of guidance and control equipment for the Nike Hercules antiaircraft missile.

Aerospace Division of Allis-Chalmers has been selected by the AEC-NASA Space Walkout Propulsion Office to manufacture insulation and engineering training for a two-stage flight test model of Jupiter Blue. Neutronium will be used in testing the NASA nuclear engine.

Pioneer and General Co., Decatur, Ala., will construct a control center for the new Saturn test facility at NASA's Marshall Space Flight Center in Huntsville. The \$1,703,487 contract calls for a two-story reinforced concrete building with basement, a 490-ft. round and supporting utility sections. The control center is scheduled for completion in late 1962 or early 1963.

First order of T-39 Suborbital for the Navy is scheduled in an overall supplier package of 65 of the aircraft from North American Aviation. Dec. 5 Los Angeles Division Navy will get 34 modified versions of the original configuration, which will be designated T-39T. The other 51 planes will go to USAF, boosting the total ordered by USAF service to 749.

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Sundstrand Aviation Photo courtesy of Sundstrand Aviation
Illustration: Boeing



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Sundstrand Aviation has supplied constant speed drives for aircraft manufacturers, and delivered over 10,000 drive units. To support its total range capability and provide a wide variety of options, Sundstrand offers a complete line of accessories to the state of the art in aircraft powerplants. Sundstrand's constant speed drives are available with or without the associated epicyclic gearbox and auxiliary requirements. Units are also available in a wider range of kW, from 100 to 10,000. Sundstrand's constant speed drives are established worldwide, controlling aircraft, helicopters, and reciprocating engines.



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Sundstrand Aviation has developed a wide variety of electrical controls to meet the needs of aircraft manufacturers for complex electrical power systems. Through the application of advanced electronic circuitry and precision manufacturing techniques, Sundstrand's electrical control systems are unique in their reliability, simplicity, efficiency and economy. Sundstrand's electrical control systems are compact, proven products, which maximize availability of starting power.



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Many Sundstrand drives are available in synchronous formats to accomplish several processes. These include constant speed drives, constant torque drives, and generators. Sundstrand Aviation has studied in extensive detail all the gear and generator requirements of aircraft manufacturers. This experience with generators includes extensive studies in load factor analysis for static and dynamic loads, and development of constant torque and constant speed drives with custom ratings for individual applications.



GEARBOXES
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HU-1B



HU-1D

Frontline comparison of Bell HU-1B (top) and HU-1D shows enlarged fuselage and redesigned right wing.

Army Field-Testing HU-1D as Infantry Carrier



Army is field-testing the HU-1D assault helicopter as an airborne transport in addition to its role as a cargo aircraft and medical transport. The HU-1B version (top) flies 1,100 miles. Long-stowed storage doors plus a quick-detach forward panel permits rapid loading. A complete 12-man infantry squad can be carried in the HU-1D (right) with the squad leader seated immediately behind the pilot for ease of communication. Twenty of the helicopters can move an entire company. Below, a squad of the 17th Infantry Division departs during maneuvers at Fort Bragg, N.C. The extra squad can leave the HU-1D in three minutes, radio equipment and all. Helicopter carrier landing skids, shown in dotted lines and at right, has additional levers and more control wires to provide improved engine cooling.



Above is field-testing the HU-1D assault helicopter as an airborne transport in addition to its role as a cargo aircraft and medical transport. The HU-1B version (top) flies 1,100 miles. Long-stowed storage doors plus a quick-detach forward panel permits rapid loading. A complete 12-man infantry squad can be carried in the HU-1D (right) with the squad leader seated immediately behind the pilot for ease of communication. Twenty of the helicopters can move an entire company. Below, a squad of the 17th Infantry Division departs during maneuvers at Fort Bragg, N.C. The extra squad can leave the HU-1D in three minutes, radio equipment and all. Helicopter carrier landing skids, shown in dotted lines and at right, has additional levers and more control wires to provide improved engine cooling.





Raytheon brings proven guidance and

Three techniques are currently available to meet the challenge of Space Rendezvous Guidance: radar, infra-red and optics. Of these techniques, radar has been used for homing guidance systems to the greatest degree. Studies by Raytheon, whose radar experience spans three decades, have indicated that continuous wave radar possesses these desirable characteristics:

- No minimum or "dead" range
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- Direct and accurate velocity readings
- Ease of acquisition
- Greater simplicity and reliability

sensor capability to space rendezvous

The experience gained from the inertial guidance system for the advanced Polaris, coupled with the proven success of the Hawk and Sparrow C W homing systems give Raytheon the most extensive proven capability applicable to the space rendezvous guidance problem.

In addition, Raytheon, one of the world's largest scientific-industrial organizations, has proven its ability to manage every phase of a complex system — from early study and design through development, production and field support of operational systems and equipment.

Missile and Space Division, Bedford, Massachusetts

RAYTHEON COMPANY

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LOCKHEED C-140, military version of the JetStar, is parked on a Military Air Transport Service markings. At present, the Air Force has ordered 16 C-140s, six of which will be operated by the 128th Air Transport Wing, Special Air Mission, MATS.

Lockheed JetStar Special Report—Part 2

Lockheed Faces \$80 Million JetStar Loss

By David H. Holloman

MNEMOTO, Ga.-based Aircraft Corp., which has spent \$180 million developing the JetStar, must sell at least 239 more of these ultra-luxury transports if its investment and probably well-hold production of new orders fail to materialize early this year.

During its first Air Force contract in 1962, Lockheed's design continued in 1965 when industry was asked to design a large transport aircraft capable of carrying 5 to 10 passengers over Trans-Atlantic routes, not only 16. With funds to all sources holding at \$5 (AW Dec. 5, p. 65) Lockheed can make current delivery losses at about \$80 million. Of this, \$65 million has been covered by before-tax write-offs and \$10 million in administration costs not reflected in Lockheed profit and loss statements. The balance, 16 million, may be recovered from future sales.

To break even, the company must sell 182 JetStars. But the odds are heavily against a prospect for new customer support, whether Grumman, Gulfstream, Fairchild, LTV or JetStar. In the fiscal 1967 Air Force budget, Orders for corporate JetStar aircraft have not kept pace with Lockheed's forecasts.

At a recent reduced rate of two per month, it takes Lockheed about one month plus行政 certification time to build a JetStar. Of the 47 JetStars on order, about 17 were to be delivered by Jan. 1. As a result, Lockheed is forced to enough bottom to keep its JetStar inventory low, but never through most of 1967.

But during this first quarter, the

company probably must decide whether production in 1968 can continue with no additional funds. It is doubtful that such decisions can be postponed, for Lockheed builds the JetStar as an off-busy and tries to gain enough orders during a specified time span before releasing subsequent lines for production.

An Air Force JetStar, all of which will

be operated by Military Air Transport Service, are three types: 5C-140As for flight checking aircrews and 5C-140Bs conversion support aircraft with convertible interiors and six VC-140s primarily for carrying sealing diplomats and presidential personnel; within can travel U.S. All VC-140s will go to the 128th Air Transport Wing, Special Air Mission, Andrews AFB, Md.

JetStar was originally prepared as a trans-Atlantic passenger aircraft by British Bristol Aeroplane Company under contract at £850,000 to British Overseas Airways Corp. for flight checking aircrews and 16

convertible interiors and six VC-140s



PRESURIZED AND AIR CONDITIONED and quiet interior of JetStar (seen from above) allows to expose all electronic components for easy replacement or maintenance. Ten inches each second and accessible through small hatch doors, lock case in place.

business JetStar also was limited to one or two customers.

Congressional records indicate that Air Force, during Fiscal 1959 through 1964, acted with the intent to purchase 100 aircraft, less 30 to 35 C-140s as transports. Here is a breakdown of how much Air Force sought, how much Congress appropriated and how much was spent:

- **Fiscal 1959.** Air Force asked for \$21.5 million and Congress appropriated the whole amount. Of this only \$15.5 million was obligated for the five C-140As.

- **Fiscal 1960.** Congress again appropriated the entire sum requested by Air Force: \$25.6 million, for 14 transports. \$10.000, however, was not used of the money was spent.

- **Fiscal 1961.** Air Force budget did not include a request for C-140 funding. However, Air Force asked for funds to spend \$12 million for the six VC-140s. December, 1960.

- **Fiscal 1962.** Air Force requested \$19.1 million for 16s, C-140s. New Congress voted only \$10 million, which was used to produce the five C-140B transports support aircraft.

Going into Fiscal 1963, the Senate Select showed that Air Force had sought a total of \$64.3 million for several C-140 programs. Congress had allowed \$55.2 million and the service had spent \$38.8 million. According to the late Robert Cruse (AWW Aug. 15, 1968, p. 51) former Lockheed chairman, the continuing emphasis placed upon space was likely to force jetpassenger aircraft market share away from the Douglas DC-9 and the development of unseated aircraft to make more seats available eliminated further funds from C-140 procurement. Tactical aircraft sales than appeared aircraft were accorded the highest priority.

In an effort to keep its JetStar assault alive over the longhorns, Lockheed is concentrating on convincing Air Force that the plane is an ideal aircraft for short-haul cargo lots to U.S. remote areas. Critical components could go via JetStar to remote bases not served by roads. It also hopes that Air Force requirements in the future will lead to the purchase of about 200 aircraft.

Concurrently, the company is attempting to link C-140 sales to the burgeoning interest of Lockheed F-104 fighters. West Germany, The Netherlands, Belgium, Italy, Canada and Japan have been invited to build a total of 1,129 F-104s. Most of these will be equipped with infrared sensor to the North American Space and Range Center (NASAR) that furnishes air-to-air position, terrain reference, course mapping and short range target information in their pods.

Lockheed has proposed the C-140,



ROLLOUT RATE of JetStar aircraft line at Lockheed-Georgia Co. plant now is two aircraft per month. Company hoped to be producing four JetStar per month as early 1962, but military orders to date have not justified the increased output.



CORPORATE JETSTAR version interior was added by Lockheed Aircraft Service of Ontario, Calif., which offers various configurations costing from \$45,000 to \$105,000 per aircraft. JetStar purchases are done directly with at least five other firms involved engineering due to Lockheed-Georgia Co. Aircraft cost does not include various options.



amr

Objective: increase capability of the Atlantic Missile Range—sponsored by the Missile Test Center of the Air Force Systems Command—to study missiles and space vehicles during the critical terminal phase of flight with a refinement never before possible. Prime requisite: *mobility*...ability to move to the most advantageous position in thousands of miles of ocean.

The answer: conversion of two large troop transports into Mobile Atlantic Range Stations, seagoing laboratories incorporating every proven technique of instrumentation, data acquisition, and instantaneous data transmission to Cape Canaveral, integrated with the most sophisticated long range tracking radars. System Manager: The Sperry Rand Systems Group. General Offices: Great Neck, N. Y.

The Mobile Atlantic Range Stations will be equipped with ultrahigh radio, telemetry, infrared tracking, data handling, communications, inertial navigation, and sophisticated weather forecasting. Team members include Bethlehem Steelbuilding, Ford Instrument, Miles & Fox, IBM, Remington Rand UNIVAC, Sperry Gyroscope Company,

SPERRY

with four to seven training consoles installed in an cabin as a flying classroom for former T-164 pilots. Such students would dictate those who would attend to monitor the various test flights of the program, while launching the payload over the shoulder increment, Lockheed semantics. These would be no need to fly the T-164 while learning to use instruments such as NASAIR. At its most, the crew is even now play T-164, attending to Lockheed.

Two JetStars sold to the West German defense force may be used later for that purpose.

In addition, there is a strong probability that negotiations in progress for another will result in West Germany's buying 2 to 4 more C-140s for training aircraft.

Robert L. Mitchell, director of air leasing for Lockheed-Georgia Co., and recently appointed as JetStar sales vice chairman, believes that Air Force also has a real appetite for about 300 C-140s to support transports need for 30 to 40 strong Lockheed C-140s to check out X-rayed missile engines, reheat at refitted high altitude and altitudes. A need for 100 C-140s and 50 revised Jetstars raised by Air Force during work preparation of the fiscal 1961 budget apparently failed to receive Defense Department approval (AW, Jan. 3, p. 21).

When and for mission support, the C-140's direct operating cost of 45 cents per aircraft round trip cargo 360 miles less than that of the Douglas C-47 29¢ but that of the Convair C-131 and C-99, less than that of the Douglas C-54, according to the company.

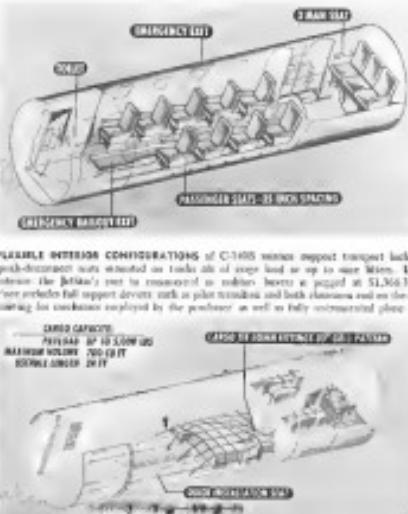
On the mid-side of this sales picture, 25 Jetstars have been ordered by U.S. foreign governments or heads of state. Of the three Jetstars sold to heads of state, one will carry President Suharto of Indonesia, but Lockheed is also a firm customer of the other two purchases.

Lockheed advises that early interest in the Jetstar, which stressed lower incorporation resulting to savings of length for storage purposes, has declined. On the other hand, the manufacturer feels that other more concessionary features have been made the clear-cut hallmark of corporate pilot will begin decreasing the Jetstar's popularity, and at this point the aircraft will begin selling well.

Diminution of the corporate pilot is another factor that seems to favor as against the Jetstar orders. If the corporate pilot who caused the birth of the long range aircraft now against having fast, radio-pilot-controlled equipment, the commercial' key customers can be expected to make greater use of airline jets. This trend will curtail the commercial' own flight operations.

JetStar Development Timetable

August 1956	Air Force issued requirement for jet utility transport (UCX) with 5-18 passenger capacity to be developed at contractor's expense
January 1957	Building of prototype started at Lockheed California Division of Burbank
September 1957	Jetstar, powered by two Bristol Olympus turboprops, made first flight from Lockheed AFB, Calif.
February 1958	Flight testing completed by Air Force
November 1958	Prototype of standard aircraft started at Lockheed-Georgia Co. in Marietta
January 1959	Patt & White, JH2A, turboprop selected to power Jetstar aircraft, to conduct weight shift in free-engine configuration
October 1959	Air Force issued Jetstar license waiver of UCX competition
June 1960	Air Force ordered first five Jetstars to check navigation aids in ATC system
April 1961	Fleet Air Arm Agency issued #8 Transport Category Type Certificate to Jetstar and granted Lockheed-Georgia Co. production certificate
August 1961	



SUBSYSTEMS DEVELOPMENT FOR MANNED SPACE VEHICLES

ONBOARD POWER - H₂-O₂ FUEL CELL POWER SYSTEM

RELIABILITY & OPERATIONAL FLEXIBILITY
Are Major Objectives of the H₂-O₂ Fuel Cell Power System Development Program at TAPCO, a division of Thompson Ramo Wooldridge Inc.

RELIABILITY
• Cell Module Design
• Spares Modules
• Reionized Fluid Components
• Low Thermal Gradients

OPERATIONAL FLEXIBILITY
Starting at -40° F. to 100° F., No Heated Cells, Spares Modules, Full Power, Within 6 Hours, Full Power In 12 Minutes After Shutdown, Quick & Low-Cost, Day or Night Operation, 2 to 100% Rated Power

H₂-O₂ Fuel Cell Power System



TAPCO
Thompson Ramo Wooldridge Inc.
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not and decrease the need for pilots. As a result, priority is given to problems unique with the JetStar.

The JetStar's initial power, its range and its intended carrier requirements probably are partially responsible for slow sales to date. Last winter, the aircraft costs commercial or military purchasers \$1,366,000, or about one-fifth the cost of a Boeing 720B with turboprop engines. JetStar's maximum range of 2,570 statute miles, achieved with a payload of 1,040 lb. and Visual Flight Rule fuel reserves, is not quite competitive with a similar aircraft under VFR conditions. And, to satisfy civil air regulations, the fully loaded aircraft requires a 6,043 lb. overweight to depart on maximum range cruise.

Lockheed emphasizes three points in what:

- JetStar's speed—One-month flight time savings from Detroit, Calif., to Boston, Mass., en route 10 hours at an average ground speed of 590 mph—this time from compensated for any required refueling stops. Even if fuel is taken en route the JetStar can fly coast-to-coast in less time than any competitive transport.

- JetStar's takeoff field length requirement decreases to 5,900 ft. enabling it to operate from at least 1,000 ft. runway lengths. At 10,000 ft. runway lengths of 1,000 and 1,100 ft. flying such a distance, the transport would carry eight passengers, a crew of two, full luggage and fuel reserves. Over 2,000-mi. distances, JetStar would need an airport with 1,100 ft. of runway.

- JetStar's price includes full support services, such as pilot transition and both classroom and on-the-job training for mechanics employed by the purchaser, as well as a fully instrumented cockpit. Also Lockheed has formed an international network of factory representatives to aid JetStar customers.

Initial selling expenses are further lowered by the company's ability to offer flexible financing, training programs, exchange options, warranties, legal support, jet aircraft management, operation and use of major and high altitude physiologies. Normal break-even general aircraft follows the introduction of JetStar, and includes 4 hr. on the general airplane, 8 hr. on electrical systems, 12 hr. on hydraulics, 4 hr. on each of 12 hr. on the JT12A engine, 4 hr. on propellers, 4 hr. on radios and radar, 8 hr. on instruments and the cockpit, 16 hr. on performance and 5 hr. on JetStar operation.

Standard JetStar flight training is 200 hr. of instruction in the aircraft. This can be decreased to 100 plus 40 hr. for certain diversified flight crews. An Atlanta Thompson Ramo-Wooldridge is the JetStar after about 20 hr. of training in the aircraft. Lockheed reports



Way back in 1956 (ancient history in the electronic industry) Marconi engineers, led by Lou

Kurtz, began working on an omnidirectional scanning antenna. Today, Kurtz has brought the "flat plate" slot array antenna "into focus," so to speak, where it is no longer theory alone but an integral component of the guidance packages of missiles and aircraft. Of course, Kurtz has an advantage in that many of the research problems because Marconi could rely on the company's long experience in missile devices (including "old hat" department). The Rimec "flat plate" slot array does away with mechanical devices and provides for "automatic" control steering, beam shaping and controlled crossover beam angles. Monopulse operation can also be obtained with integrally packaged hybrids. Glinted areas can be within several inches of the radiating surface reflecting impinges due to microwave living space. Because there is no frontal feed horn, there is no blocking of the aperture and very low side lobes result. There is no diffraction which results the efficiency is inherently greater than with reflector type antennas.

Now, let's face it. Can something really be exotic when so many have been produced?



*Marconi engineers
for the slot array

GALL LORI ANGELITO, RANTEC DIVISION • ADDITIONAL ANTENNA FIELD SYSTEMS, RADIOTELEVISION, MULTICARRIER, ULTRA-PERMISSIVE AMPLIFIERS, TEST INSTRUMENTATION, AND RF SUBSYSTEMS



**Communications...
the heart
of
space
achievement**

One day in the future, man will set foot on the moon. Of all the factors that will contribute to that success, communications will have played a vital role. Through wires, through space, straight telephone, microwave, against wet winds, guide and land the space craft, will allow man to earth communications, will perform thousands of functions necessary for success. Research at Amherst Laboratories in wire propagation and microwave and millimeter wave technology is playing an important role in present achievements and will continue to do so in the future.

PROFESSIONAL STAFF AND MANAGEMENT OPPORTUNITIES await Physicists, Mathematicians and Engineers Register with us for advanced degrees and leadership positions. Send resume or correspondence to Mr. H. L. Johnson, Professional Employment,

AMHERST LABORATORIES • 110 WILHELM DRIVE, WILLIAMSVILLE, NEW YORK
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NEW AEROSPACE PRODUCTS



Altitude Environmental Chamber

Nineteen cu ft chamber is designed to reproduce extreme environments of altitude, temperature, and humidity simultaneously for evaluation of equipment performance.

Morelli has the Model 2000 chamber can simulate altitudes from sea level to 100,000 ft; temperatures from -400 to +100° and 10-99% relative humidity over a broad temperature range. The 2.5 x 2 x 1 ft. chamber is fitted with ports for transmitting electrical, pressure, or hydraulic signals to test equipment. (Evaluation Co., 7149 San Fernando Rd., Burbank, Calif.)



Holding Entry Director

Device is designed to enable a pilot to visualize quickly and accurately his position relative to the building pattern and thus follow the entry procedure illustrated on the scale.

Manufacturers claim that two sets of the director scale will enable the pilot to determine his position in relation to all of the entry procedure, his selected reentry path, and his landing heading, which are fitted on the respective scales. Height and plan distance are shown in a 5 x 7 in. scale.

Enzo, Inc. 44-443, Miami International Airport, Miami 55, Fla.

SPACE TECHNOLOGY

Manned Space Flight Simulated on Ground

By Erwin J. Behn

Dallas Tex.—Complex manned space entries are being duplicated here with a high degree of realism, including most of the physical stresses involved, using a new simulator designed and built by Chance-Vought Corp.'s Avionics Division.

Capable of simulating virtually any type of manned space vehicle from earth orbital to high-speed interplanetary configurations, the system is capable of handling all the various phases of such entries including launch, orbit, reentry, entry, and emergency guidance, descent, landing approach and landing. It is also adaptable for studies involving conventional aircraft, vehicles that would operate in the atmosphere and in space, and various reentry and landing methods.

Basically, the avionics system consists of a gondola containing a cockpit with completely mechanized pilot displays and controls, fastened to a moving base providing freedom about roll, yaw and pitch axes. A pivoting base plate of rotating the gondola through the 360° entry and reentry. It also has a fixed portion of counter weight located on one side of the underground concrete complex, for providing specific vehicle characteristics, flight parameters and control valve configurations.

System cost, including the testing complex facilities used in operation is estimated at \$2 million.

Spacecraft Studies

Simulators will provide the division of Long-Term Vought with the capability for making detailed and controlled studies of the entry and their variants. It also will provide a facility for training and indoctrination of flight crews.

The simulator is expected to be a major research tool for the division's Life Sciences Section, in conducting physiological studies on subjects in the simulator, and for determining the effects space vehicle stresses will have on man and his ability to perform necessary planned space mission tasks.

Providing an insight into some of the work the company is planning with its new equipment, Wadsworth Group Supervisor William B. Lakin told *Aerospace*: "Work that initial studies made in the course of developing the equipment included:

• Close liaison of a two stage Saturn system with an Apollo type three stage upper, covering the least profile from



COCKPIT of Chance-Vought simulated spaceflight simulator is equipped with control and pilot displays. The cockpit gondola is mounted on a moving base, providing freedom about roll, yaw and pitch axes. Effect has three small windows in front and six sides to view star field and horizon lines which are projected on glass walls of dome surrounding the cockpit configuration. Propeller is mounted above a jet-like head. Pilot has a viewing full pressure suit.



OVER-ALL VIEW of Chance-Vought simulator shows entry module's control panel in foreground, with the simulated flight module gondola in background, under fiber glass dome. Closed-circuit television series in control panel enables module to watch pilot during simulated flight. Television camera is mounted on nose of cockpit gondola. System is designed to simulate all phases of space-atmosphere flight.



Tenney... a team for space age research



For complete information on any of these Tenney capabilities, write directly to Robert R. Brown,

Manager Division 1033 S. Euclid Street • South Park, Calif.

Western Division 1033 S. Euclid Street • South Park, Calif.
Electron and largest manufacturer of Environmental Test Equipment

Aerospace Division For the simulation of the entire environments of outer space. Space simulators engineered to create, simulate and evaluate the effects of extreme physical, solar radiation, thermal heat, oxygen and orbital motion.

Environmental Equipment Division

Environmental chambers, for the simulation of altitude, humidity, vibration, heat and low temperatures, explosion, sand and dust. For conformance to military specifications, as well as industrial applications.

Acoustics Division

Complete acoustical test facilities, to create high intensity, wide-band noise comparable to the internal and external noise of vehicles and jet aircraft; reverberant, plane wave and anechoic chambers for acoustical qualification tests, sine fatigue tests, transmission loss studies, and materials evaluation.

Ground Support and Systems Division

To develop and produce servo, hydraulic, pneumatic and electronic test apparatus, which simulate flight conditions for pre-flight checkout of aircraft and space vehicle instrumentation and controls. Design and develop electronic variable speed drives and hydromechanical DC supports.

Tenney Western Division Exotic material interaction, erosion testing and associated Ground Support Equipment fabrication, as well as West Coast Facilities for all other divisions.

Communication Measurements Laboratory, Inc., Plainfield, New Jersey
100 Bradford of Tenney Engineering, Inc.

Research, development and manufacture of power amplifiers, precision AC and DC power supplies, transistors, static inverters, electronically-powered accurate systems, solar systems, and RF equipment.

For complete information on any of these Tenney capabilities, write directly to Robert R. Brown,

length, based on a mean mission:

- Continuous approximating sinusoidal flights
- Earth-orbit type injection mission
- Earth-orbit type rendezvous mission, in which orbit was established and orbital insertion was developed, although an actual rendezvous target was not attempted or established

Indications are that Vought Astronautics research efforts with the aerospace research flight simulator will concentrate on exploring all facets of the relationship of man to the spacecraft, with the view of determining how much, rather than how little, can contribute to the operator.

The wind tunnel dealing the main supersonic flow over the aircraft for a possible, recording, by ultrasonic and taking low loss air of the long and often turn radius, nosecone devices should be most effective.

Mission Profile

In the regard, mission profiles consider man controlling the vehicle from launch—although technicians here do not at this time a major requirement for him as a crew duty—separating the booster and igniting the second stage, terminating the power stage and following payload stages, making guidance corrections to achieve proper orbit or other flight course, and returning the data received to the complete system through return to earth rate, landing.

Then they will packed displays and cameras can be audience cabin equipment with can also be stored.

The closed loop audiovisual system continues operation under real-time control.

The nosecone has a gimballed type enclosed cylinder with fins distributed by Vought Astronautics engineers or base of a complex space glide-type reentry.

The upper portion of the shell covering the cockpit slides forward to permit entry, and the nosecone contains three windows that might be made of flexible plastic to withstand reentry impact. The forward part has a machete slot and pilot's seat, in another shell shield which would close off the part on reentry.

The pilot seat is a bolstered front covered with vinyl seats. The seat is designed so that later it will be possible to introduce vibration damping, similar to those experienced during an actual launch or flight.

Also to be added early in 1962 will be heat and noise shields, with heating elements providing wall temperatures up to 240° and a high fidelity speaker system and tops, soundings gun emitting nuclear capsule and atmospheric sounds up to 120 db levels. In the meantime, Astronautics Division is working

type of the booster generated in the Mercury capsule during Astronaut Alex Shepard's flight, which will be fed into the lead-in to the booster engine.

Flight Controls

Flight controls include a side-arm type, a two-degree-of-freedom platform for maneuvering masses, wheels, although capable of being rugged, in other areas, engineering is currently set up to simulate control of four variable thrust rocket motors mounted above, below, fore and aft of the vehicle's center of gravity, a rocket engine fire tube simulating firing and control of an auxiliary engine for changing orbital paths and retro-firing during descent, landing gear control, and drag chute control.

A major consideration in the cockpit is the ground support matched instruments and display panel, as it is planned to provide the pilot with the capability for monitoring separately or in conjunction, boost, orbit, and return for orbital rendezvous, descent, reentry, glide landing, laser, heat, landing and launch control.

Mechanized displays are considered vital efforts. An important portion of research with the simulation will be devoted to developing new instruments and panels to cover requirements based on experimental work by scientists here, as well as independent research both at under contract from industry or the services.

A television screen is incorporated in the pilot's layout as that a large number of displays can be tested by projecting them onto the cockpit from a remote location, located beneath the seat.

Projection System

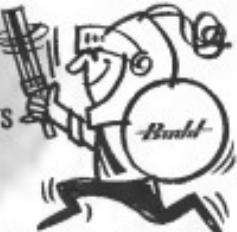
Also the cockpit is a projection system, presenting a series of the earth horizon and star field against the 20 ft. diameter fiber sphere which encloses the projector gantry.

The pilot's external view is a bright sun with a straight horizon at level, rising or receding as simulated attitude changes during the mission. The horizon is movable in pitch and roll and the star field is visible in a portion of the compound vehicle body area gantry.

As the pilot "flies" his space mission, the angular motion is depicted in the center of the sky, from the vertical launch position through varied maneuvers required to accomplish the flight, with the earth's horizon meeting the star field and horizon changing position as relative to the earth as they would during an actual mission.

Missions generated by the moving base closely simulate those a pilot would find during maneuvers. When the pilot, for example, initiates a maneuver, the gantry is accelerated about the pitch, roll and yaw axes at the rate of 65 g's.

COOL HEADS for HOT SPOTS



(Dr. The Stirring Saga of Sulfur Hexafluoride Subdued)

Over coffee one recent morning four engineers always as right as a stickle during coffee breaks, we observed the end of the stirring lathes of our Environmental Control Systems Department wearing a grin that can be described only as Cheshire. Ignoring previous experience under the stimulus of present curiosity, we inquired into the cause of his grin.

Solvent

the direction

of air isn't good enough for it

to be used as a pressurization gas for many of the high-power waveguide sections" being used today. The best job in done by SF₆—gas that packs 2 to 3 times the detectable weight of air at normal pressure, and even more at higher pressures.

Projection System

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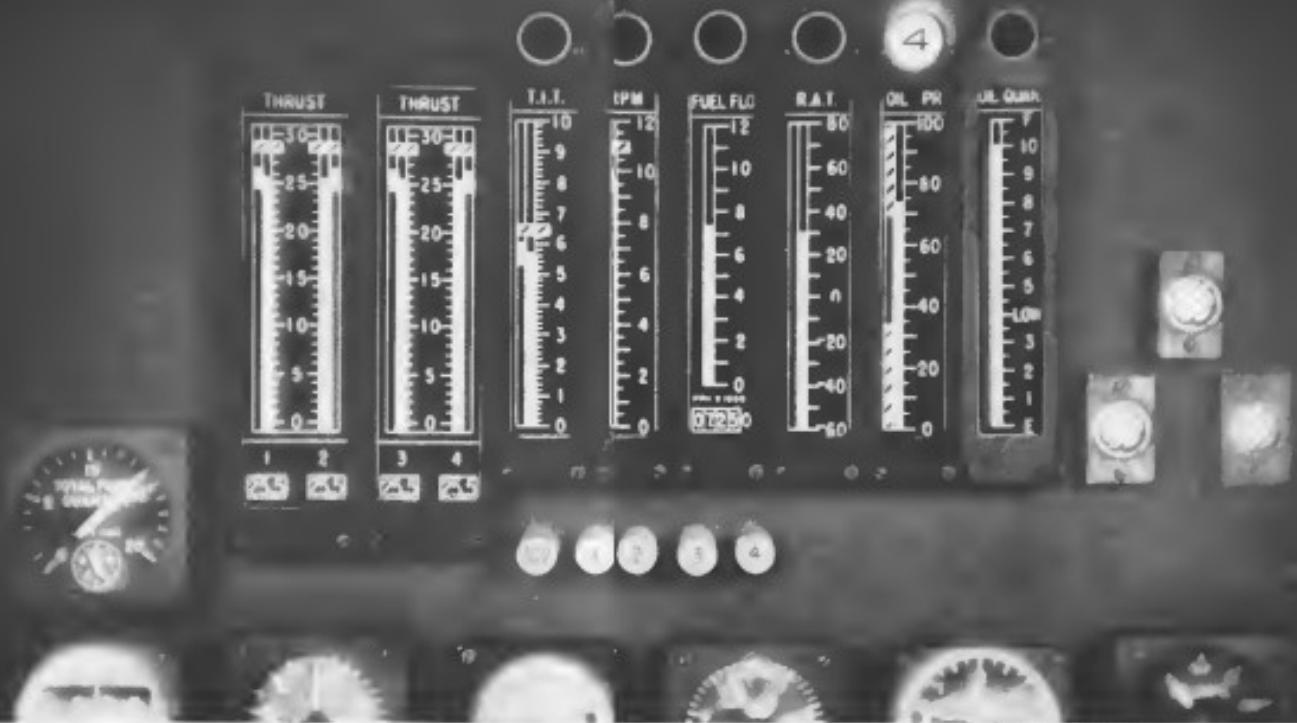
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Bald Head 100-200 SF₆ Heating System



Data Processing & Display Systems
RF Systems • Earth Sciences
Environmental Control Systems
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Spot it first with the new Bendix propulsion data system. This advanced digital computer system offers a new high-resolution vertical scale display that simplifies engine management and saves panel space. The system automatically monitors parameters of all engines 2½ times each second...earmuffingly displays the worst performance of each parameter...signals when to take corrective action. Vertical scale instru-

ments feature electro-luminescent lighting and provide a running visual comparison of actual performance with optimum and "never exceed" values. Each engine can be monitored separately when desired.

The system handles engine management for an entire flight profile. It relieves crews of time consuming calculations required by engine management charts. The results

are a considerable increase in efficiency of engine performance, increased fuel economy, and longer engine life.

This new Bendix propulsion data system is adaptable to any number of engine families and to any type engine...turboprop, turbogear, VTOL, STOL, multiengines, and single-engine. On a typical four-engine turboprop aircraft requiring 36 indicators to present 36 conditions of engine

performance, the new system presents 20 conditions of engine performance on 10 indicators in 16 lbs. space. Developed by Bendix in cooperation with the Air Force's Flight Vehicle Section, Aerospace Systems Division, the system offers a new concept in aircraft engine management efficiency. Write to us in Teterboro, New Jersey, for a copy of our booklet, "Propulsion Data System."

TROUBLE IN ENGINE #4

Eclipse-Pioneer Division



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UNLOCK
THE FUTURE

VIBRA-

In jet engines?

CEC Vibration Transducer (4-124) will tell.

It's all new. It detects the slightest jet engine vibration at ground level or in-flight monitoring. It has a temperature range from -65°F to 300°F. Peer-and-squeezed, it's 1/4 in. dia., .25 inches high, hermetically-sealed, tough as rock and will last a long long time. How many do you want? Call your nearest CEC office or write for Bulletin CEC 1638-XI today.



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Transducer Division

CONSOLIDATED ELECTRODYNAMICS
PASADENA, CALIFORNIA - A SUBSIDIARY OF BELL & HOWELL

presence at the pilot's seat, pinching up to approximately 9G's for short duration in pitch and yaw. At this point the motions associated with entering a maneuver. Since the motions are located in stroke, the resulting acceleration can be sustained over very brief 3-second intervals. In the complete return, abrupt gondola velocity and stroke ceasing to reverse the acceleration before the gondola has its stop. However, deceleration forces are situated below the human feeling threshold and the gondola returned to the initial position. Thus the pilot feels only the acceleration forces associated with the start of the maneuver. He need generate forces on the panel and through the pilot's controls to provide him with the correct impression of the maneuver's felt strength, so that he logically, or at least, does feel it. Even though with the gondola caused to handle the vehicle and energized the system.

The entire simulation operation is directed from a control station located in a separate room. This facility has a central console, plotting, various control panels and other equipment necessary to simulate absolute control.

The console includes separate controls for each of the flight instruments in the gondola cockpit, a television screen showing the pilot's face, shoulders and torso, flight configuration selector allowing start of a flight in any desired phase of the mission, ballastage test switch allowing source selection between water and air, a panel used to provide de-icing equipment, etc. switches which can be used to simulate landing flaps, landing gear, nose gear and emergency hydraulic and pneumatic systems to simulate the main data system operation.

A safety station also is located in the station with the gondola so that a caution can be transmitted immediately in event of a malfunction.

Successful Woomera Rocket Series Ends

Joint U.S.-Australia British Islands space flights from the Woomera Range in South Australia have been completed in a program designed to measure atmospheric conditions from space in the stratosphere.

The program began in September and involved the use of British Skylab sounding rockets and instrumented probe packages designed by the National Aeronautics and Space Administration's Goddard Space Flight Center.

Each instrument had over 10 techniques sensitive to the ultraviolet spectrum. The payload rotated slowly to scan the sky after it was separated from its launch rocket.

USAF Contracts

An F-104 Office of Scientific Research contract awarded to Grumman and contracts totaling approximately \$2.5 million to Langley Research Center for research programs and radar development grants were for the following:

McMurry University Research Contract (4-104-459) for solutions to noise.

Pennsylvania State University Research Contract (4-104-457) for ultrasonic wave propagation in supercooled and normal ice.

University of Alabama Research Contract (4-104-456) for studies of ultrasonics and vibration.

Massachusetts Institute Research Contract (4-104-455) for nonresonant piezoelectricity.

University of California Research Contract (4-104-454) for ultrasonic velocity theory.

Stanford University Research Contract (4-104-453) for ultrasonic wave propagation.

Pennsylvania State University Research Contract (4-104-452) for effects of liquid crystal on ultrasonic propagation of surface waves, shock propagation.

Pennsylvania State University Research Contract (4-104-451) for ultrasonic dispersion of glass.

Stanford University Research Contract (4-104-450) for ultrasonic dispersion in liquid monomers.

Massachusetts Institute of Technology Research Contract (4-104-449) for ultrasonic methods to study ice formation.

Pennsylvania State University Research Contract (4-104-448) for dynamical properties of glass.

University of Illinois Research Contract (4-104-447) for ultrasonic dispersion of ice.

Massachusetts Institute of Technology Research Contract (4-104-446) for ultrasonic dispersion of aqueous organic mixtures.

Pennsylvania State University Research Contract (4-104-445) for effects of reduced pressure on ultrasonic dispersion.

University of Wisconsin Research Contract (4-104-444) for application of ultrasonics to the oceanic environment.

University of Michigan Research Contract (4-104-443) for ultrasonic analysis of ice-crystal growth patterns.

Massachusetts Institute of Technology Research Contract (4-104-442) for measurement of atmospheric conditions in space.

University of Michigan Research Contract (4-104-441) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-440) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-439) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-438) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-437) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-436) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-435) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-434) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-433) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-432) for ultrasonic dispersion of ice-crystal growth patterns.

University of Wisconsin Research Contract (4-104-431) for ultrasonic dispersion of ice-crystal growth patterns.

TION?

In trucks, trailers, flatcars?

CEC Accelerometer (4-202) will tell.

This info gives you acceleration (1 cubic inch, 2 cubic inches) and electronic equipment strain gauges (just like us, it happens to be better than all comparable accelerometers). In, lower mass response, smaller damping, change with temperature, highest resonant frequency, operable temperature range from -20°F to 300°F. And it's just as durable as that one over there on the left. Need some? Call your nearest CEC office or write for Bulletin CEC 4302-X12.



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The Lincoln Laboratory program for ballistic missile range measurements and penetration research includes:

EXPERIMENTAL RESEARCH

Measurements and analysis of ICBM flight phenomena; fire discrimination and for decay decay processes; including optical, aerodynamics and RF effects.

SYSTEM ANALYSIS

Studies to apply research findings to advance the technology of ICBM and ABM systems.

INSTRUMENTATION ENGINEERING

Designing radar, optical and telemetry equipment sets which to measure ICBM flight effects under actual space conditions.

RADAR SYSTEMS RESEARCH

Establishing the theory and applicability of radar techniques to problems of discrimination, conformance and performance in a dense target environment.

HYPersonic AERODYNAMICS

Study of the flow fields around reentry bodies for various body designs and flight conditions; location computer facilities available.

RADAR PHYSICS

Theoretical and experimental studies in radar back scattering interaction of RF radiation with plasmas.

*A more complete description of the Laboratory's work will be sent to you upon request.

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

Research and Development
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 BOX 28
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and basic research interests.
 General Dynamics, New York, White Plains, New York, has conducted a series of experiments on the development of a nuclear weapon system involving research in astrophysics, Mathematics, 20, Leslie, 30—
 32, 340, has a contract of \$10 million for development of weapons.

Art Force has recently awarded the following contracts:

Boeing Co., Seattle, Wash. Two Boeing 727 aircraft for personnel transport of 15 T DDCI aircraft. 16 Total aircraft will be delivered by 1968.

Polaris Corp., San Ysidro, Calif. 1000 Polaris missiles for submarine-launched missiles.

Convair Division, San Diego, Calif.— 1000 for production of guidance assemblies for the B-52 bomber. 1000 for the B-52 bomber. 1000 for the B-52 bomber. 1000 for the B-52 bomber.

Rockwell International Corp., Downey, Calif. 1000 for production of anti-submarine weapons systems for the B-52 bomber.

McDonnell Douglas Corp., St. Louis, Mo. 1000 for production of the F-4 Phantom II fighter aircraft.

Lockheed Aircraft Corp., Sunnyvale, Calif. 1000 for production of the F-104 Starfighter fighter aircraft.

Grumman Aerospace Corp., Bethpage, N.Y. 1000 for production of the F-111 fighter aircraft.

Convair Division, San Diego, Calif. 1000 for production of the F-105 Thunderchief fighter aircraft.

American Space Systems, Inc., El Segundo, Calif. 1000 for production of the Thor missile.

General Dynamics, Fort Worth, Tex. 1000 for production of the F-106 Delta Dart fighter aircraft.

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New Offerings

Custom Metal Products, Inc., Bronx, N.Y. engaged in the manufacture of metal components and electronic hardware to precise tolerances. Offering 10,000,000 square inches at \$4 per square foot. Proceeds will be used to repay certain loans, to finance the purchase of new production equipment, to expand the manufacturing facility, to research and development, to secure the establishment of a property, issue of corporate securities, enhance working capital, and to finance.

Continental Industrial Electronics Corp., Los Angeles, Calif. engaged in the development, engineering, and manufacture of industrial and government special purpose outlets, switches and the manufacture of commercial television picture tubes. The company was organized in October 1961, for the purpose of securing the assets and assuming the liabilities of Continental Electronics Corp. of California offering 10,000,000 common shares at \$1.50 per share. Proceeds will be used to finance the acquisition of basic assets to support the business, to locate facilities, to effect an effort to purchase additional equipment to enable the company to produce certain components for electronic relay sets, and to obtain qualification for certain military type tubes. To increase productive capacity, for advertising to the industry, to finance additional research work.

Mitron Research & Development Corp., Waltham, Mass. Incorporated in May 1960, engaged in research to develop new methods and methods and techniques for materials testing, to develop and design products and devices resulting from or derived directly from the company to meet advancing engineering specifications of the electronic, material and space industries. Offering a 1,190,000 common shares down by the company at \$1 per share, and 1,53,000 outstanding shares by the holders (after completion of the company's sale) at par and in excess of those presently in the market the common stock. Company's proceeds will be used to the development of projects including the construction of an electron wind simulation device, a high temperature X-ray camera, a portable mass spectrometer and plasma/atomic power converter and ionizing discharge for fabrication purposes.

Union Electronics Corp., Grand Haven, Mich. engaged in the manufacture of high precision instrument components for medical and missile guidance systems. Offering 210,000



PURITAN RIDES the BOEING 727

... FOR GREATER PASSENGER SAFETY. Puritan's automatic valve assembly for passenger outlet stations has been specified for the oxygen breathing systems in the Boeing 727. It is a compact, integrated unit with all the valves and the latch combined, and enables passengers to be supplied with emergency oxygen if needed.

Your inquiry on any problem concerning high altitude breathing systems and equipment would be welcome.



Puritan automatic valve assembly is mounted in the passenger outlet and above the passengers, and in the lavatories.

AIRSPACE DIVISION
Puritan EQUIPMENT, INC.
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 A subsidiary of PURITAN COMPRESSED GASES CORPORATION

BREATHING LIFE INTO AIR AND SPACE TRAVEL



**THEY RELY ON
RADIATION
for proven PCM telemetry in Titan**

The recent launching of an Air Force Titan IICb1 missile has a PCM telemetry system built-in for the first time. Designed and built by Radiation Incorporated, this advanced system also works tracking, and more important, first in the telemetry field. An capability of processing both digital and analog data in a single compact unit, it is giving



Radiation pioneered PCM techniques, and is recognized for many of the significant advances in the state-of-the-art. This long-time company offers extensive current experience in a broad spectrum of scientific and engineering applications. All qualified applicants will receive considerations for employment without regard to race, creed, color or national origin. For details on Radiation—and its latest PCM developments—write Dept. AW 12, Radiation Incorporated, Melbourne, Florida.

With the spaceborne system, Radiation provides an Input Simulator for problem checks and a Ground Checkout Pack for ground synchronization and decoding. Capability of further conditioning the spaceborne package with existing Radiation circuitry for low-level signal conditioning makes practical the universal system approach.



**RADIATION
INCORPORATED**

common shares at \$2.50 per share. Proceeds will be used for the purchase of additional testing and production equipment, to refine current lithobiolysis to lower additional potential, and to increase inventories and receivables.

Aldora Industries, Inc., Westham, N.Y., engaged in the design and manufacture of pressure hydraulics, pressure and fluid valves and various control mechanisms for aerospace, marine and submarine to provide systems protection, proper sequential operation and desired pressures, to metric flow paths, purge, venting, piping, etc. Offering 50,000 common shares at \$1 per share, 15,000 should be used for the purchase of new equipment, \$5,000 maintenance, \$1,000 by Edward Berlin, president and sole stockholder. Grosser's proceeds will be used to purchase capital equipment and to expand its sales organization.

Marina Electronics Corp., New York, N.Y., engaged primarily in research, design, development and production of advanced electronic systems and supporting equipment for the space field. Offering 20,000 outstanding capital shares. In September 1961, the company issued 75,000 units of shares to William L. and Dale V. Hopkins in exchange for the ownership interest of Hopkins Engineering Co., wholly owned by the Hopkines, and their promise to sell the 20,000 shares. Hopkines will be responsible for the early market expansion for industrial and military applications, and Elton for radio interference reduction.

SMS Instruments, Inc., Jamaica, N.Y., engaged in the repair, maintenance, testing and overhaul of instruments and accessories for military and commercial aircraft. Offering 150,000 common shares at \$1.25 per share. Proceeds will be used to purchase additional equipment and special parts for surviving jet aircraft, to repair the balance due on a bank loan, to repay over due accounts payable, to settle federal and city tax obligations.

Transtech, Inc., 12 Capri, Calif., incorporated in September, 1963, for the purpose of conducting research and development in the field of solid-state devices and sensors, and to conduct business in research and development in the areas of communications, aerospace, defense, and space-time basic science components for planetary generation, wave recording and status controls and standard electronics products. Offering 40,000 common shares at \$5 per share. Of the proceeds \$175,000 will be applied to the acquisition of short-term bank financing.



Taber Transducers are Martin choice to pick up engine data during Titan flights

Operating as components of a Martin Co. Instrumentation System, Taber Transducers, Strain Gauge Pressure Transducers gather important engine performance data during flights of the Air Force's Titan IICBMs. The 0-750 psi Taber Transducer, shown above, checks the pressure of engine number one thrust chamber. Three other Taber Transducers are used to measure (1) engine number one start gas pressure, (2) sustainer motor igniter manifold pressure, and (3) engine gas generator pressure. Martin chose these instruments "because of their ability to continually give accurate data even when subjected to extreme temperatures."

Taber performance advantages are many: high frequency response, infinite resolution, hysteresis less than 0.35% full scale, and low sensitivity to temperature effects, shock or vibration. Models are produced for a wide variety of test, ground support or service applications, with pressure ranges from 0.05 to 0-10,000 psi.

Detailed and illustrated literature on Taber Transducers may be obtained by simply mailing the coupon attached to your letterhead.

TE TABER INSTRUMENT CORPORATION
ASYSTOL ELECTRONICS DIVISION SECTION 40
107 Boundary Street, North Tonawanda, N.Y.

First priority shipment on Taber Transducers and Insight Insulated Sheath pressure transducers

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The presentation of any kind of image—photographic, electronic, or anything better that may occur to you—is the human brain for a judgment of what it shows and whether it matters in today's business. Electronics is helpful in this type of work but can't suffice. Here we enter the realm of psychology and psychophysics, science in which Kodak's foundations, for safety's sake, have to go down to bedrock.

Which brings us straight to the reason why Kodak is prepared to take up the pioneering role in this category. They need doing. Present equipment needs to be updated to the possibilities of present information-gathering systems.

A greedy crew of Kodak-visionaries have devoted a fair number of Kodak man-decades to study of the capabilities and limitations of hu-

man vision. These men are not employed to put out fires encountered in the course of conducting a film and cameras business, though it is true that film and cameras paid their salaries. On the scientific foundations they have been laying down, their engineering colleagues can raise the state of the art of image presentation to new heights.

Visual engineering is also handicapped in that its helpful contributions look odd. [The object seen gets attention, rarely the act of seeing.] Look at the picture on the opposite page. You are looking into an experimental Kodak viewing device, just behind a translucent screen on which an image is projected from behind. No matter how sharp the original picture and no matter how good the projector lens, the simple machinery behind

the screen can always yield a noticeable improvement in the sharpness. It does this by introducing time as an integrating factor to cancel out optical noise due to inherent local random fluctuations of intensity that are inherent in efficient transmitting diffusers.

It also makes the image more pleasant to view at. Staring at a screen for long hours of unusual concentrations exposes psychological conditions different from those an engineer encounters when he takes a look and decides everything is good and sharp and that his Position along the comfort-anomalous zone strongly affects systems that unlike eyes is a gateway to brain.

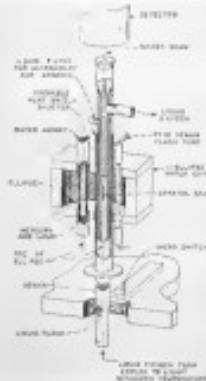
We can help because the science and engineering of visual happiness are all but long been very sober business for us.

PHOTOGRAPHY
OPTICS
ELECTRONICS
MECHANISM
INFRARED

For a discussion of new approaches in image presentation or in other applications of the technologies in which we work, or for a booklet entitled "Kodak's Face in Business" that defines them, communicate with Advanced Planning Department,



AVIONICS



CONTINUOUS WAVE solenoid: typical motor operated by Bell Telephone Laboratories provides millions of power at continuous wave strengths near 1.05 microns (400). Duallapping coilwindings which are simultaneously layed up the upper and lower ends of coiled rods, as much as 24 in. in length, in a vertical lathe are used. Solenoid is continuous (cyclic) as in Laboratories of Despatch, Inc.

Services to Push Optical Maser Effort

By Harry Miller

Los Angeles—Department of Defense and the armed services will maintain their support of research and development in optical wave substrates this year, reflecting mounting military interest in the potential use of these devices as optical and electronic switching techniques.

Considerable spending on training past programs, while individual costs may vary, will likely double the estimated \$5 million spent by military agencies to date on special needs R&D.

or will be in the next several weeks.

Most of these new programs are originating from unanticipated proposals, in which several agencies are usually involved. Others have been, or will be, used for military bidding.

Meanwhile, there are initiatives that the members founded, *ad hoc*, optical sensor committee, composed of representatives from various companies.

initiatives from DOD Advanced Research Projects Agency; Institute for Defense Analysis; and various research laboratories, will recommend supplemental congressional funding for fiscal year 1980 and possibly other initiatives on models and developments for one or two previous applications.

第二部分

First Report
Set up in the Office of the Director of Defense Research and Engineering to manage R&D in this area, the committee will develop its first report this autumn to DODIN Adjutant Group on Electronic Warfare. Dr William Collier, a research scientist from the Rand Corp., has been assembled as the committee chairman. The Institute for Defense Analysis has been assembling data for the committee during visits to optical sensor research firms throughout the country.



How to guide a bull by the nose

Most bulls can get pretty mean. Some are just less mean. Like the Air Force Titan. It's not

The Titan II is a beautifully built missile that weighs 110 tons and can travel over 6,000 miles to strike its target.

What keeps Titan precisely on course during its long flight is a super computing system created by UNIVAC®. This system sends continuous correction signals to a traveling Titan in the wink of an eye, with unfailing accuracy.

The composite mean-time-to-failure of all operational Titan I guidance systems to date is more than 800 hours... about 15 times the contractual requirement! It's the most reliable computing system ever devised. It was caused from time by Überwerk teams of scientists, mathematicians, physicians, engineers and technicians.

It's another example of Univac's total capability to create new systems to meet today's defense needs. If you're in the guidance business, talk to Univac. We're partners.

LIPUVA 6

First with 99.9% reliability.

UNIVAC

DEPARTMENT OF PROPERTY RATES CORPORATION

KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with facts about alloy steels. This month's topic is alloy steel availability, or where it will be of interest to you in other areas, including uses of brass as a pressure tube material and its use in aircraft. Contributions from our readers

Cold-Finishing of Alloy Steels: The Cold-Drawing of Bars

Cold-finishing of alloy bars may be divided into two general categories: (1) cold-drawing, where the bars are pulled through a die with no surface removal; and (2) turning and grinding, and grinding and polishing back of which remove the surface. Only the cold-drawing procedure is discussed here.

Cold-drawing is the process of pulling a pickled-and-annealed bar through a die for the purpose of producing a bright, smooth surface finish, and close tolerances. The alloy bars are prepared for cold-drawing by pickling in a hot solution of dilute sulphuric acid followed by rinsing. This is followed by a water rinse, and immersion in a hot free-water bath to neutralize the effects of the acid, as well as to aid in carrying special liquid lubricants onto the die.

Alloy bars may be cold-drawn in any of four conditions: as-solved (annealed), as-solved (tempered), quenched and tempered. These conditions are determined by the grade of alloy steel, heat-treatment, and the mechanical properties desired for a given end use.

In cold-drawing, the alloy bar is machine-pulled to reduce the size at one end so it will pass easily into the die opening. Otherwise, the bar is pushed or extruded into the die by an auxiliary device. A die-holder, which can be made to rotate from one to four dies, is mounted in an appropriate head assembled across a "draw bench," so that from one to four bars may be drawn at the same time. The draw bench has a bed which accommodates a fixed borgy with jaws that

grip the pointed ends of the bars as they emerge from the dies. The borgy has a hook-on end which engages an end-sucker, thereby pulling the bars entirely through the dies.

After cold-drawing, each bar feeds automatically into a straightening machine, and is sheared as "center-cut" to length on appropriate machines. Bars are cut and when the measurements of the bars are too large to be cut by shear, or when square ends are required:

Smaller sizes in the form of rods are drawn in "ball-blocks," or "wire-blocks," depending on sizes, followed by straightening and cutting on special machines.

Specifications for chemical composition, grain size, hardnesses, and the like of cold-drawn alloy steels have been given in long study by Bethlehem metallurgists. If you would like suggestions on cold-drawing projects, or any other problem concerning alloy steels, our metallurgists will be glad to give you all possible help, without cost or obligation on your part.

In addition to manufacturing the entire range of AISI alloy steels, Bethlehem produces special analysis steels and the full range of heat-treated carbon grades.

This series of alloy steel advertisements is now available as a compact booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.



ALLOY STEELS
—Drawing
—Finishing

could be made unusually high also. • **Semi-finish: semi-automatic, tracking**—High angular accuracy obtainable with optical master ranging system makes the device self-aligned for this class of application.

• Nonspun:

In the normal tracking category are: • **Semiactive guidance:** Principle here is the same as in spin, except that vulnerable ranges would be more extended. A version of this type is being considered as a semiactive guidance system for the Strategic Air Task Force (SAC) Airborne Defense System (ADS) (AVN Jan. 17). Stabilized tracking beam on the aerosol light beam directed at a target by the optical master in the optical section of the environmental stabilized tracking and guidance system. Value of this system would be in the extremely high resolution made possible by the master's collimated light beam and the difficult as errors would have in managing the system. A decision on whether to go ahead with this system probably will be made before the summer.

• **Ballistic: ranging:** Several Army agencies, the Signal Corps and Pathfinder Agency among them are interested in the high ranging accuracies and resolutions of the tracking system using various location-corrected signals to provide against noise, temper and personal errors, windshields, etc., when flown in face of right locations in heliocentric solar elevation around.

Besides these general categories of applications, there are others where feasibility and practicality are open to question. The possible use of the high power density in high energy lasers from an optical array as a radio wave source or death ray length increased in the flat field of searchers on these devices (AVN Jan. 19, 1968 p 57) is interesting enough although a recent publication in the *Journal of the Optical Society of America* (Vol. 55, No. 23, Dec. 23, 1968, Vol. 56, p 671) indicates that an optical master consisting in the blue-green region of the spectrum is incapable of detecting soliton-like pulses (AVN Apr. 10, 1969 p 21) is somewhat discredited. Navy's Special Projects Office had asked for proposals on this, but discontinued the program when this information showed it was impractical to build the device. The point needed to positive side entry is in point that a range of a few hundred yards could surpass by some, if not all, that can be expected.

Another seems to be developments in optical tracking as the creation of a nonresonant laser, feed back control of the master and the operation of an optical master using an organic molecule in an organic glass. This is said to be a significant step in the accelerated pace of development in the field as reported here recently by scientists from Bell Telephone Laboratories at a meeting



OPTICAL MASTERS ranging and telescope, similar to one in operation test year of Orlon, N.M., on the White Sands Missile Range, will track Deltav 2 satellites like the Air Force Infra-red Camera. Discover shown being illustrated in Aviation Week staff concept. Light beams generated by the system will range off precisely selected targets every 100 m. sec.

meeting of the American Physical Society. The development regarded as a success, logical next step in the program leading toward practical optical master lasers for communications gives the user his high power devices, perhaps less complex than the ground-based lasers mentioned above. The same people who developed at Imperial College in England could reduce primary requirements and another frequency range to those at which optical lasers have already oscillated.

Random Sampling

A random sampling of the new government funded optical master programs indicates that most of them involve device plus a few system studies. Thus, while no formal development is being carried out on the optical master, perhaps the most significant development is the joint research between the University of Michigan and Imperial College in England. This research will be continued at Imperial College in England and another frequency range to those at which optical lasers have already oscillated.

Aviation Antiaircraft in Mountain, Calif., has a \$1 million ASMD contract to develop the 55mm telescope, a pair of 35mm auxiliary visual acquisition tracking telescopes to be mounted with the main system, and a large passive tracking system.

Scanning systems will be provided for the optical master ranging transmitter and the receivers on the basis of relatively quickly due at Durban Jan. 19. Holders are expected to include Avian Antiaircraft, Hughes, Loral Industries, Optics Technology, Radio Corp of America, Raytheon and Tisai

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. Robert John, Resident Steel Expert, Director



BETHLEHEM STEEL

NEW SIMULATORS



ATTACK SUBMARINE TRAINER captures a "clash" of ocean miles wide and fathoms deep, with multiple targets, including aircraft—indoors. Environmentally realistic Air Task Centers of three classes of interior sets are used to train crews. The seascapes seen through the periscopes

are in full color and targets change bearing, size and aspect in real-time battles progress in this digital computer-powered dance. The computer program generates as many as nine different versions and also determines hits or misses as if in actual combat.*



Replica duplicates operational missile in exact detail

Little John warheads are manufactured by Honeywell's Ordnance Division, Lakewood, Honeywell developed

the Little John Trainer which is a full-scale replica having the exact weight, dimensions, and balance of the operational missile. It is used with operational launching equipment and GSE. All phases of handling, check-out and launch are simulated realistically—even to smoke from motor ignition and burning.*

Shipboard device cuts cost of training crews

Mk 6 Launcher and Missile Simulator exactly simulates launcher and missile functional inputs, without utilizing operational equipment. By-passing of the operational launcher reduces wear and maintenance, keeping it constantly available for tactical use and permits shipboard weapon system training without the expense of flying live missiles. The simulator also provides capability for refunction insertion for trouble-shooting exercises. The Mk 6 was developed under the direction of the Bureau of Naval Weapons.

LOWER RISK, COST OF "COLD WAR" TRAINING

Honeywell specializes in all areas of this challenging technology

Economy-of-money and amount of operational equipment required—is the key to the success of simulation specialists. If men can be trained without firing an operational missile, or, if a simplified version can substitute for a complex, expensive device—money is saved. Likewise, an economy is realized if a trainer-simulator replicates operational equipment,

leaving it for strategic deployment. This is especially true in team training where large amounts of equipment might otherwise be tied up. Simulation is at its best in the training of complete teams.

Simulation is planned, technological wizardry—wizardry that is amazingly realistic. The success of simulation lies in analyzing operational assignment and substituting simulated inputs for the operational equipment. The net result is appreciable savings in "hardware" and money, while retaining a realistic training environment.

Simulation involves optics, sound, dynamics of motion, electronics, mechanics, and discrete applications of human factors engineering. Honeywell has a wealth of experience in these fields, including space, navigational, terrestrial and marine simulation. The examples shown here are proof of this capability.

If you would like to know more about Honeywell capabilities in designing and producing trainers, contact your local representative, or write: Honeywell Ordnance Division, Davis, California. Sales and Service offices in all principal cities of the world.



Missile launcher provides realistic "in action" feel

Ridgeye, an infrared homing missile fired from a lightweight, hand-held type launcher, arms the ground soldier against low-flying aircraft. Honeywell's Ridgeye trainer, which is currently under development, will simulate the effect of blasting and tracking. The simulator will provide both battle weapon training and damage-control proficiency, without expenditure of a live missile.*

ASROC Trainer serves fleet

The ASROC Trainer is a shore based installation of six shipboard components containing a total simulation of sonar, radar, fire control including a special purpose computer, and associated equipment. This ASW team-trainer prepares fleet personnel for the tactical deployment of the ASROC Weapon System.*



*Pending final contract award under the direction of the Naval Training Device Center, Port Hueneme, New York.

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The twin-engine Northrop T-38



can take off



climb at 6800 fpm



accelerate to Mach .95



maneuver at 40,000 ft.



and land



on only one engine

On two engines it can climb at 30,000 fpm, fly at Mach 1.35, and reach 56,000 feet.

Instrument. There were three previous Air Force theoretical and experimental studies of the system, two at Hughes and one at Optics Technology & Research.

• **Hypersonic optical sensor**—Balkin Inc. contract to develop a 10-megapixel optical sensor will be issued soon by ASD in the Air Force armament division for high-outputs power USAF's Space Systems Division is making funds for the program available. At the time the agreement was written, 10 mega pixels were regarded as a reasonable approach under goal, but developments have caught up with the Air Force's performance. Several integrators have been advanced to the laboratory so far.

• Liquid optical sensor

Contractors are seeking a liquid optical sensor in which a liquid is a liquid solution with the liquid density or viscosity set at the active medium. It will be completed in a \$15-million research and development contract to be awarded this month by Air Force's Space Systems Division. Contract will call for a study of achieving a cry-optical sensor capable of generating 40-petabytes data storage.

Several companies submitted proposals for the contract to Space Systems Division. The seven are believed to include General Motors, General Precision Laboratories, Electro-Optical Systems, Radio Corp. of America, Quantum, American Optical, Technical Research Group and Wetzler.

Using a liquid could avoid the thermal problems of cooling the sensor but introduce other problems like the probable low oscillation strength and the great breadth of the spectral line in a liquid sensor. Cooling of a liquid optical sensor could be achieved with a liquid crystalline solution. Pending effort is spent a liquid system have failed.

Mass Liquids

Once the contractor finds appropriate mass liquids, he will be expected to build experimental devices, although the contract will not cover an assessment of potential applications.

• **Radiation weapons study**—Contract to perform a study of the effects of a radiation weapon using an optical sensor (AW Oct. 25, p. 39) will be awarded shortly by Rome Air Development Center. This is one of several current studies of radiation weapons employing an optical sensor.

• Experimental weapons

Air Force's Franklin Research Center will soon award a contract for development of a hand optical sensor, capable of generating high-density radiation, for experimental purposes. While the output of this device is a low and would likely be suitable as a weapon, it is an electronic device for radiation weapons calibration.

• **Battlefield range**—Inden-Avray has earned a development contract for 100-ft-range electro-optical battlefield range-finder light source high-bandwidth optical sources on the basis of results of two earlier performance design studies performed for Franklin Research Center by Hughes and Technical Research Corp. (AW Apr. 24, p. 31, Sept. 11, p. 92).

• Infared imaging systems

Infrared imaging systems for missile-homing applications will be the subject of a \$83.5-million R&D program at Quantitative, Santa Monica, Calif., according to the Department of Commerce Daily. Spotted surveillance under study now are not made known by the Daily, nor would company officials identify them. The Navy order is known, however, to have been awarded to Quantitative in October 1986 for the \$30 to \$45 million range in which the Russians imported an bare hand weapons Quantitative's visible optical sensor effort is directed by Dr. Theodore Miron, who operated the first optical sensor in his country while at Hughes nearly two years ago.

• **Modulation/demodulation techniques**—One of the difficult and still largely unexplored phases of optical sensor technology, the generation and demodulation of optical signals will be explored in several Air Force and Army Signal Corps activities expected before later Rome Air Development Center, and in a lesser degree, ASD, appear to be the lead agencies in these areas.

The Army Signal Corps will also be active with an effort for a solid-state demodulator/demodulator for optical sensor communications systems.

• **High-frequency sensors**—Aerospace Station Division is planning to initiate an industry study of high-frequency sensors, which could generate outputs around 100 kHz or higher. Although these are not optical sensors, they do represent another strong impulse the possibilities of obtaining useful outputs in a relatively practical portion of the electromagnetic spectrum. These frequencies lie in the high-frequency end of the microwave band, which corresponds well those the top oscillating frequencies of proton microtron resonators and well below those of optical sensors (AW Jan. 1, p. 13).

• Sensors

• **Electrochemical**

• **Optical**

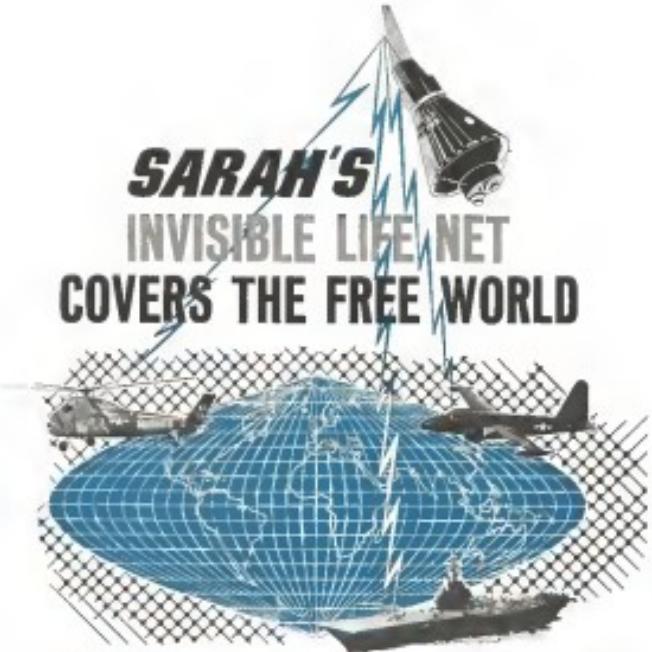
• **Microelectromechanical**

• **Terahertz**

• Terahertz

• **Terahertz**

SARAH'S INVISIBLE LIFE NET COVERS THE FREE WORLD



SARAH (Search And Rescue And Recovery) systems have operated successfully in every Project Mercury launching and recovery. The innovative SARAH transmitters supplied for Mercury by Simmonds Precision Products, Inc. in automated astronauts during descent, after extraction of all environmental forms of space flight. SARAH receivers installed in aircraft, ships and stations throughout the free world, receive the beacon signals and report location of the capsule.

SARAH assures quick, safe, dependable recovery of America's astronauts.

The outstanding success of SARAH has focused increased attention on its proven capabilities in personnel location and recovery applications, for which it was originally designed. Civilian agencies and the military are increasingly using SARAH for the most effective personnel rescue operations.

SAP **Simmonds**
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ity. There are, in addition, system problems of which modulation techniques and regeneration methods are present.

Current research is guided by optical engineers, indicating that the situation in the crystal may be more complex than had hitherto been thought, suggesting a possible need for closer investigations. Dr. Edward S. Bishop at the Naval Ordnance Laboratory, Silver Spring, Md., has been studying noise and spectral coherence of optical beams with the aid of high-speed photographic techniques. He has found a number of in-depth models in optical noise sources and has submitted a report on the subject to the Physical Review Letters.

He further suggests that the degree of instantaneous optical coherence in optical wave pulses may vary over a wide range of light sources. This is a single item.

In DOD interests, there are roughly 400 companies conducting some form of activity with optical materiel today. This staggering number is causing a few companies, with a depth of resources and desire, to look twice before investing funds in optical materiel projects.

They reason that \$5 or \$10 million of government funding will spread sparsely among 400 companies.

R&D Pioneering

Yet within the industry and among knowledgeable technical people associated with the services there is a strong feeling that with a large handful of these 400 have the personnel and facilities to conduct significant pioneering R&D in this field. The wish unanimous expressed is that these organizations begin testing the 400, or those not active in optical sources now, seriously their efforts and thereby accelerate the development of this field.

There are today perhaps 10 or 12 organizations with substantial optical materiel programs under way. None lead high among these can be Bell Telephone Laboratories which has over 1000 people at work on a company budget exceeding \$3 million annually, with a fraction of which will be maintained by a small Signal Corps contract. Other world-wide Technical Research Centers, Hughes, Goodyear, Quaker, Northern American Optical and Johns Hopkins University Technical Research Group has received over \$2 million during the past 2½ years. Hughes about \$1 million in the last 18 months. Radio Corp has an extensive materials effort supported under a \$100,000 ASD contract. Other companies making strong efforts include General Electric, Sperry, Grumman, Westinghouse and International Business Machines.

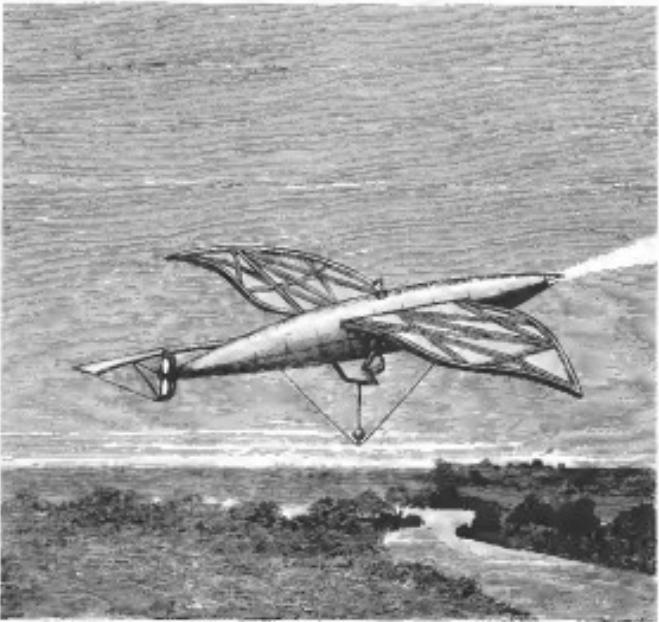
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TALOS
PIONEER
SIDEWINDER

TIME TO TRAVEL...in a bld, or elsewhere, this K.W. Haydon trivector motor is unique. We started our successful Vanguard II subminiature DC motor, for power, to a tiny new version of our well known and patented trivector gearmotor, for precision. Result, it will drive miniature tape recorders, printed circuit commutators, polarimeters, and such things...and hold its speed to within $\pm 0.5\%$ of the speed you want, even if the shaft load, line voltage and ambient temperature vary widely. It weighs a mere two ounces and measures less than $1\frac{1}{2}'' \times 1\frac{1}{4}''$, yet delivers at least 30盎seounces of torque at 1 rpm. For full information on this <16000 motor, or any other sort of trivector device, electronic or motor driven, just write.



AWHAYDON
COMPANY
222 NORTHFIELD STREET, WATERBURY, CONNECTICUT



Nickel-containing alloys would have helped...

give this steam-driven "hard" a better chance of getting off the ground even back in the 18th century.

But, like many of yesterday's ideas, this aircraft was constrained in its age that lacked the materials, methods, and materials to make it reality.

Today, transforming visionary designs into practical, high-per-

formance products is a common occurrence—thanks, in no small measure, to alloys with exceptional combinations of properties.

For example, you might require an alloy providing excellent long-life qualities at high stresses and temperatures up to 1800°F.

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or solid-state optical switch; a single crystal rod of calcium tungstate emitting brilliant ultraviolet rays as the wave passes. The laser generates sufficient total radiant radiation at 1065 nanometers. This radiating wave length has been varied through several short wavelength down to 114 nanometers with four different crystals employed to date.

Continuous oscillation of a solid-state device was reported after the same power increased until the second section of a photodiode, having the material, thus, making possible operation at power levels available from dc sources. The new timer has operated continuously for 20 days, pulsed in a 500 watt dc lamp, but fluorescents could oscillate indefinitely under continuous excitation.

As experimentally tested at Bell, the device implies an elongated cylinder, or cube, the walls of which are coated with evaporated, highly polished aluminum. The dc lamp at one focus of the cavity concentrates pumping light on the crystal at the other focus.

The issue was a filer to remove unfiltered ultraviolet and infrared radiation from the output beam. A quartz window, held to 70°C. automatically, or, however, that will not exceed certain critical characteristics of maximum strain such that continuous wave operation at room temperature will be possible at the filter.

Tracking Telescope

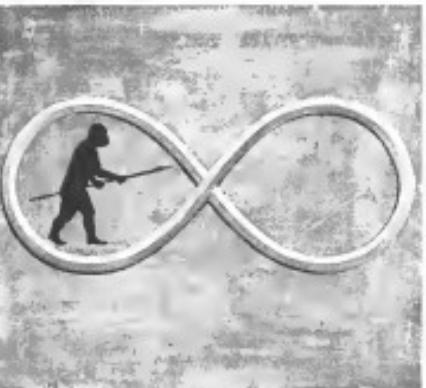
The tracking telescope being developed by American Astronomers for the Air Force must be built for use in low, "Mete" of a probe-shaped head where the telescope will have a fixed length of 310 mm. enlarged in magnifying of the probe from 10 to 1000 mm. in total length. It will be caused by a 50% increase in 160 mm. of the telescope. The degree of resolution required of the telescope will be 1.5 arc sec. Approximately 550 lb. of experimental gear can be carried with the telescope.

Astronomical and engineering assistance will be provided by Elwin and Gross of Lockheed, Tex.

Two 150-mm. quadrant photometers will enable scientists to be initially equipped. These will be usable for about 40 sec. when at 200 km. altitude. 60 sec. at 300 km. above Colorado. These scopes can automatically track on the basis of signals obtained from video tape record.

The telescope is that Duranite telescope, launched by USAF from Vandenberg AFB, will be principal ranging target. Distant targets are anticipated to pass over Colorado at altitudes between 120 and 200 km. (geometric of 120 km. to 150 km., speed of 900 to 750

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HUGHES 269A HELICOPTER weighs 1,895 lb with full load (25 pfd). Maximum permissible gross weight is 2,350 lb providing for a payload of 400 lb. Maximum hover ceiling of the aircraft is ground effect is 5,300 ft.

Aviation Week Pilot Report:

Hughes 269A Aimed at Untapped Market

By William S. Reed

COLOR CITY, Calif.—Hughes 269A two-place helicopter, a stable, rugged aircraft designed for use of operators and maintenance personnel produced by Hughes Tool Co., is aimed at tapping a market not previously being served by any business aircraft or helicopter.

Flown by the Aviation Week pilot, Hughes 269A, another N 8731F proved to be considerably easier to operate than larger, more complex helicopters. Potential customers without extensive aviation background should have little difficulty obtaining a helicopter rating in the 269A in the predicted 25 hr flight time.

Along with a production rate which Hughes hopes to attain in the fall of 1970, general in the Sheppard Motors Co. in Los Angeles, is established in the sales and service of heavy construction machinery, the Sheppard Co. has been using fixed-wing aircraft for transportation. Although venturing into the field of helicopter sales seems somewhat remote from

an economic marketing program for planes and construction personnel, the market thus created appears to warrant a prospectus for a marketing plan.

While not able to employ a fixed-wing aircraft, the cost of \$22,500 and operating costs as low as 13 cents/mile are far less than Hughes believes they can sell 269 269As per year.

An example of the type of business Hughes hopes to open up for his helicopter sales is the dealership for the 269A general in the Sheppard Motors Co. in Los Angeles. It is established in the sales and service of heavy construction machinery, the Sheppard Co. has been using fixed-wing aircraft for transportation. Although venturing into the field of helicopter sales seems somewhat remote from

heavy construction equipment, it actually makes sense. Hughes considers the market for construction machinery as an ideal market for the 269A because their operations often are in a remote area and landing areas for fixed-wing aircraft seldom are available.

Outlines of the sale are made available for the light helicopter, according to Hughes, and thus hope that through dealers like Sheppard, the advantages of the helicopter can be demonstrated to a large segment of potential customers who might never get near an airport. Not all dealerships are granted in business unrelated to aviation, however, and many dealerships are going to find themselves in the field of aircraft dealers.

Training will be conducted locally by the dealers because Hughes believes coverage and advice, plus maintenance

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climbing speed is 85 mph. Absolute ceiling is 71,500 ft. Flare riding in ground effect at 6,300 ft., 4,300 ft. out of ground effect.

The 250A is designed for high coloane production, which Flugler Vice-President-Sales Al Boyer says will result two per day within one year. Some of the design features which permit such a division include:

- Simplified blade construction—A unique, diamond cutout forms the leading edge, and nose cap of the blade, around which a triangular sheet skin is bonded to the spine and to a rounded wedge leading edge. Assembled, this is put into a peg in a cutting oven where they are held in position until a vacuum is applied to the blade. Through this method replacement blades can be sold for \$350. Blade life, present at 1,400 hr. and will be increased Flugler reports add. The rotor blades feature a steel prop bonded to glass fiber skin. Life of range rotor blades is 1,200 hr. and replacements cost \$70.00 each.

- Tail rotor torque tube—Construction of a single piece light-weight tube about 7 lb—the torque tube is splined at either end and has no midpoint bearing to serve. Within the tail tube, housing a single Teflon whip bearing at midpoint. Contact between tube and housing is intermittent and designed only to eliminate binding.

- Engine cowling of plastic—Non-insulated parts such as underbody fairing, exhaust nozzle, nose cowl, engine shroud, etc., are constructed of molded plastic. Lightness and corrosion resistance coupled with required strength are among the advantages, Flugler maintains.

Simplified Flying

There's the 250A, a simpler and more economical aircraft than flying after fully articulated rotor helicopters. It still does not have the inherent positive stability of fixed-wing aircraft, but it also requires less attention to flight than the fully articulated can be. The aircraft, like the Lockheed L-1011 transport aircraft, it wants for direct television and the所需要的 helipad for pilot more under constant reference to the altimeter to detect a cloud or dove.

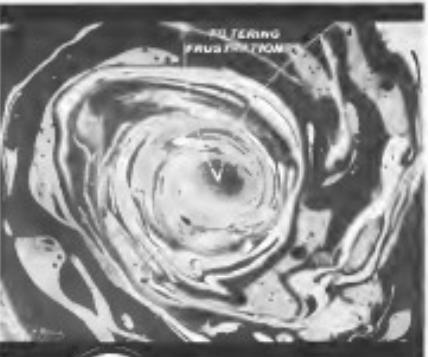
A trim system whereby the pilot of unassisted control pressure, during steady-state flight and a variable friction ratio allows individual adjustment from zero to home control system forces.

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PRODUCTION LINE at Hughes Tool Co. Aircraft Division turned out first helicopter August 1961, 2½ months after start. Deliveries at end of 1961 stood at 15. In addition to the 15 onhand in the foreground, eight others can be seen coming down line in center of floor. First is located at Hughes Airport, Culver City, Calif.

main rotor indicator, sensitive altimeters and overfold pressure gage. Anti-torque gyro is provided for engine or preventive engine oil temperature rise, cylinder head temperature, fuel pressure, fuel quantity and generator output. Red warning lights are provided for transmission or pressure limit and/or oil temperature. The anti-torque gyro warning lights have a continuous light and a short flash that turns on automatically—the two short flashes and their instant on/off are used if the lenses on the bulbs are in bright sunlight.

Starting the engine is accomplished with an electric motor. After smooth engine operation is attained at 1,000 rpm, the clutch lever is moved forward, tightening screws on the eight bolts and engaging the rotor. When fully engaged, engine rpm will be 1,200 rpm. Throttle is not advanced to rotor as engaged. After operating temperature are attained, ignition is checked at 1,000 rpm.

Takeoff is accomplished when the engine reaches 2,700 rpm, at which time rotor speed comes up to 470-500 rpm. Raising the collective while holding a good amount of leftudder results in a vertical takeoff when the machine can fly. Maximum rate of climb is 1,000 ft/min. Rate of climb at sea level, a resultant loss of altitude. Collective pitch was reduced and a transition to glide smoothly made without undue loss of altitude. Autorotation landing was accomplished without undue strain because of the helicopter's light disk loading and good controllability.

standard dia. is 1,150 rpm. Tires are about 5,000 lb. x 4.5 mm.

In the air the Hughes 209A slingshot handling qualities. Directional stability is enhanced by a dorsal fin on the tail boom and longitudinal control is exerted by a stabilizer. Like most rotary-winged craft in which this pilot has flown, the machine requires constant attention to maintain lateral stability. The helicopter is somewhat like flying a small plane except with an entire set of gyroscopic dynamics it attitude are not damped because propeller torque is lacking. Control forces are light despite the lack of boost and it appears the 209A could be flown by a 10-year-old even though

209A Advantages

Advantages of the 209A high power-weight ratio were demonstrated by Hughes aircraft research manager Jim Gustafson when the rotor speed was allowed to drop below the maximum of 400 rpm. It was necessary to trade on airframe weight to regain the last rpm. Rotation was kept at 1,000 rpm of flying gear. Similarly, when the air was not able to hover, the machine had to maintain rate of climb, forward flight. Best climb speed is 100 ft. altitude is 63.70 mph after which climb speed is reduced to 45 mph. Power is adjusted by using the throttle to control main blade pressure and collective pitch to control rpm. Rate of climb at sea level,

The wheels, which are stored on the forward part of the skids, can be used for running takeoffs which may be necessary at high altitudes or at elevated gross weights. The machine can be hopped forward and this speed gained by raising on the skids if a vertical takeoff cannot be made. The skids are moved to the center of the skids for low-speed takeoffs and landing. The skids are also used on the landing skids side for greater loadings in the case of uneven terrain and also allow the helicopter to settle down more gradually if a landing doesn't happen to turn out the way the pilot planned. Ground resonance also is believed to be minimized with the conforming effect of the shock-mounted skids.

Variables is very good in all directions in the 209A. Of speed, one is the rated range subject to the rear of the cabin which permits backward visibility so that rearward flight may be safely accomplished. The rear window also permits the tail rotor to be cleared by the pilot prior to starting engine and reducing noise.

Hughes 209A is an outgrowth of the VTHO-100, a 1955 Army-funded developmental program which did not go into production but stimulated the light observation helicopter (LOOH) program. Commercial certification of the helocopter was obtained in April, 1959. Production commenced in July, 1960, and the first completed aircraft rolled off the line in August, 1961. At present 42 fixtures stand at 15 laboratories.

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MANAGEMENT

Bureau of Standards Seeking Halt To Exodus of Top-Level Scientists

By Philip J. Klass

Washington—National Bureau of Standards is losing some of its top-level scientists to higher paying industry jobs and it is this, rather than the number of government scientists leaving for industry, which has focused attention on the problem, according to Dr. Allan V. Arns, director of National Bureau of Standards.

A related problem also stemming from the growing emphasis, however modest, on government salary increases is the increasing difficulty of attracting top-level young graduate students.

The results of recent Bureau of Standards studies may be representative of the problems facing other govern-

ment laboratories. Arns headed a group which recently completed a government-wide study of the problems of attracting and retaining scientific and technical talent within the federal government. The report is due to Congress in March.

Initially, universities which formerly augmented science departments at the teaching and holding appointments, although not on par with those offered by the government, have been unable to attract top-level young graduate students.

For example, in the past several years the Bureau of Standards has sought to fill a number of dozen chief openings, which generally are GS-15 civil service grade paying a top salary

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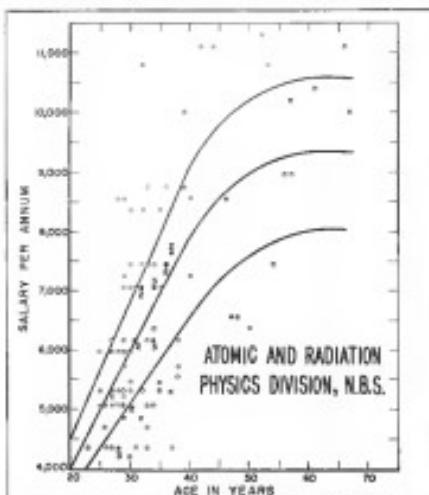
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SHOCKLEY MERIT INDEX plots salary of individual scientists as a function of age, thus establishes four "quartiles" which divide salary into four sub-groups of equal size. Figures shown are for National Bureau of Standards divisions as of October 1959.

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Supersonic Tow Target Used in Project Highspeed

Supersonic tow target (DPM-MFD) developed by Del Mar Engineering Laboratories via and in Project Highspeed (AW Oct. 4, p. 21) to evaluate air defense capabilities of Convair F-106 and McDonnell F-4H interceptors. RADAR transponder target section was tested at Mach 1.5 by both types of interceptors and showed solar reflectivity and advanced characteristics of earth jet bombers. It also dispenses colored powder for high-altitude road tracking. Tow target is housed externally on the supersonic interceptor and is ignited by combustion rod launcher mounted on an extending girder.

has been no significant change during the interval, a source says. Mark Indra should have received majority stakes.

The source says that the former shareholders have an average Mark Index of 0.33, compared to 0.73 for 90 of the new investors who were employed by Bureau of Standards 10 years ago. This would appear to confirm the trend disclosed by

Indra at the division chief level. Although a general increase in bureau stock seems indicated, the more pressing problem is the ability to raise the cut off for top-level marks.

At present the bureau has only 15 super-grade authorizations which permit salaries greater than the \$15,800 level. That permits only one-third of the division chiefs to receive salaries above

this figure. Yet when industry makes offers to such people, they switch jobs for \$12,000 or more. Dr. Atiles says. Bureau management is studying the issue passing the part test. Department of Commerce received submissions for five more supergrade positions, of which one went to Bureau of Standards.

Dr. Atiles estimates that the Bureau of Standards needs 100 super-grade authorizations.

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—Gossard

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Allison's well-equipped facility is located in Indianapolis, Indiana, if you're interested in graduate work, a graduate study program is available at the new Purdue University center in Indianapolis. Also concerned are Butler and Indiana Universities. Send your resume and write for an interview to Mr. V. A. Rhodes, Professional and Scientific Placement, Dept. 841, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

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How the Phantom II Affects Advanced Base Logistics

The combat value of an advanced base is directly related to the efficient use of its supplies. Defense planners, seeking to increase the combat potential of advanced bases, quickly come to grips with the economics of logistics. The two-mission Phantom II simplifies the logistic problem because this one airplane provides the capability for not only air defense, but also for long range air-to-ground strikes and troop support. Yet Phantom II support personnel and equipment requirements are no greater than for other fighters with single mission capability.

The Phantom II can effectively deliver

Sparrow III and Sidewinder missiles against air-to-air targets in addition to a full range of ground strike "iron" bombs and nuclear stores. Simply varying the armament of the Phantom II fits the advanced base to shifting combat situations in minutes, in any kind of weather, day or night.

This two-engine, two-man, Mach 2+ fighter holds world speed records for 500, 100, and 3 kilometers, has crossed the continent in 170 minutes, reached an altitude of 98,560 feet and has a dash speed in excess of 1500 mph. Combat equipped, the Phantom II operates easily from existing 5000 foot runways.



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Phantom II Fighter and Attack Aircraft •

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